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The

Practical Medicine Series

COMPRISING EIGHT VOLUMES ON THE
YEAR'S PROGRESS IN MEDICINE AND SURGERY

Under the General Editorial Charge of
CHARLES L. MIX, A.M., M.D.

Volume III

The Eye, Ear, Nose and Throat

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TABLE OF CONTENTS

THE EYE

Trend of American Ophthalmology.................... 11
Diagnosis 15
Congenital Anomalies 32
Refraction 48
The Eyelids 64
The Conjunctiva 77
The Cornea 85
The Iris 87
The Retina 96
The Lens 102
The Optic Nerve 118
Glaucoma 122
The Vitreous 145
The Ocular Muscles 152
The Eye and the Ear 164
The Eye and the Teeth 174
Tuberculosis of the Eye...........................177
Ocular Therapeutics 182
The Field of Vision 196
New Instruments 201

THE EAR

Hearing and Deafness..............................211
Miscellaneous 235
The Middle Ear 248
The Mastoid and Sinuses...........................276
Other Complications of Aural Infection............306
The Internal Ear 313

THE NOSE AND THROAT

General Considerations 327
Diseases of the Nose..............................333
    Acute Rhinitis 333
    Miscellaneous Nasal Conditions................340
    Ozena 357
    The Nasal Accessory Sinuses...................372
    Hay Fever and Asthma..........................381

Diseases of the Mouth....................392
Diseases of the Throat....................398
    The Tonsils....................398
    Miscellaneous Conditions....................329
Diseases of the Esophagus....................340
Diseases of the Larynx....................447
Bronchoscopy and Esophagoscopy....................469

FOREWORD

The period covered by the 1924 Year Book of the Eye, Ear, Nose and Throat has been marked by a number of important contributions to the subjects of otolaryngology and ophthalmology. The various journals whose efforts are limited to these fields have recorded a number of signal advances in operative technic and therapeutic procedure, while those in which are comprised the more inclusive interests of medicine and surgery have devoted a notable degree of space and attention to otolaryngology and ophthalmology as important factors in general body function.

The number of meritorious papers offered in the literature on these subjects renders the task of deciding which contributions should be noted a very difficult one; the editors have been obliged to omit a large bulk of noteworthy material, and rather stringently to choose that which they believed the busy practitioner would find most serviceable and generally applicable in his professional activities.

The Editors.

THE EYE.

THE TREND OF AMERICAN OPHTHALMOLOGY

After a retrospect of thirty years J. O. McReynolds[1] thus outlines the trend of American ophthalmology.

"Whole groups of diseases have lost their serious menace, and in the future will become relatively rare. Ophthalmia neonatorum will no longer take its heavy toll among the children of our country. The advanced and destructive forms of trachoma are being rapidly eliminated, and with this progress will go the necessity for operations correcting lid deformities resulting from this disease. With the marked diminution in severe, chronic conjunctival affections, and with the improvement, in the treatment of nasal affections, there has been a distinct reduction in the most troublesome forms of lacrimal disease. In fact, the infectious processes involving the superficial ocular structures are rapidly assuming a less important rôle, and with the increased facilities in transportation and communication, all of the more obstinate forms can more readily gain access to efficient modes of management.

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(1) Jour. Amer. Med. Ass'n., Aug. 25, 1923.

A notable change has developed with regard to pterygia. The extremely large pterygia covering the major portion of the cornea have become less frequent, because of efficient treatment more promptly employed; while the small pterygia, especially among women, have materially increased in number because of the more prolonged exposure to wind and dust, incident to motoring and other forms of outdoor life, which in recent years have become more prevalent.

On the other hand, many other kinds of ocular disorders have apparently increased in number, especially cataract and glaucoma. Senile cataract has actually increased by virtue of the fact that we have in this new country a relatively larger percentage of comparatively old persons. And unless some more effective mode of prevention or retardation shall be developed, we may expect an increase in the number of cataract operations. This increase will be still further augmented by the more frequent employment of intracapsular methods of extraction of immature cataracts in order to avoid the long and disheartening period of slowly approaching blindness, as the cataract proceeds in its tedious process of ripening.

In the case of chronic glaucoma, the increase may be more apparent than actual, on account of the greater care and skill commonly employed in the making of a complete and thorough diagnosis.

It is safe to foretell that in the future there will be a much greater emphasis placed on diagnosis by the aid of the Gullstrand slit lamp microscope and other highly specialized optical instruments, and particularly by a more critical study of underlying systemic conditions and a more searching investigation into obscure focal infections and postocular lesions.

In fact, medical ophthalmology must assume a position of greater magnitude, and operative procedures will be undertaken only after the most exhaustive inquiry into every possible cause that might be a factor in producing the diseased condition or in modifying the process of healing, or the final result, should an operation be regarded as essential in securing relief.

The whole subject of so-called asthenopia must demand renewed energy in ascertaining the relative importance of anatomic anomalies and functional disturbances operating through the central nervous system.

As the demand grows for more accurate work in diagnosis through unremitting diligence and care, the demand will also grow for greater skill and precision in the actual performance of such operations as may be considered judicious. And, as abundant experience is a requisite for the highest technical skill, the public may regard it necessary to recognize as ophthalmic surgeons only those who have acquired notable proficiency in this art. Such a condition would by no means imply that medical ophthalmology was in any degree inferior in its requirements or in its compensation to surgical ophthalmology. On the contrary, it is highly probable that the medical ophthalmologist will have many advantages in the preservation of this physical vigor from the exhausting solicitude necessarily associated with important ophthalmic operations, especially of the intra-ocular type.

A survey of the daily work of any busy ophthalmologist will disclose the fact that the more opulent patients do not predominate in the surgical group, and most of the leading ophthalmologists will testify that their principal income arises from their nonoperative cases. It must be admitted also that while ophthalmic surgery is the oldest and most distinctly specialized of all branches of surgery, still it remains confronted with certain difficulties and dangers that do not pertain to any other kind of surgery. And because of these hazards, the proportion of unqualified successes has never approached the degree of perfection that would be popularly supposed to exist.

If one compares the operative results in cataract and in acute and chronic glaucoma with the whole group of operations in abdominal and pelvic surgery, one will be struck at once with radical differences which emphasize the greater hazards of intra-ocular surgery.

In what other kind of surgery would a few drops of blood, as from minute retinal or choroidal vessels, produce irreparable disaster?

Most serious operations in general surgery are for the removal of abnormal growths or tissues, while the most important intra-ocular operations aim at the restoration of the function and comfort of a perfect optical organ, with preservation of size, form and intra-ocular tension. Myriads of illustrations could be adduced to show the increased hazards that pertain to all intra-ocular surgery.

Then, in the various operations on the extrinsic ocular muscles, we have to contend not only with the mechanical problems presented by anatomic deviations from the normal, but also with the uncertain and variable influence of the nervous system on the harmonious cooperation of twelve muscles which must work with mathematical precision in all of the infinite number of positions in which the visual axes may be directed.

Finally, we should not forget the significant fact that our professional progress is related not only to medical literature and individual experience, but also to personal contact with the leaders in opthalmologic thought. This contact is of immense assistance in more accurately assessing the value of the various contributions in the written volume of our labors, and even more in the vitalizing stimulus of strong, active and courageous minds working together in hearty sympathy in a common cause.''

DIAGNOSIS.

The Ophthalmoscope in General Medical Diagnosis. The ophthalmoscope, invented for the study of eye conditions, has been chiefly applied to the observation of the more gross and obvious alterations that seem important because of their effect on the function of vision. But there are changes in the ocular fundus more subtle, yet perfectly definite and easily discoverable with the ophthalmoscope, that are of great importance through their power to reveal the presence and course of general disease. Edward Jackson[2], who has used the ophthalmoscope almost daily for the past forty years, predicts a rapid and large increase in the use of this instrument as an extremely important diagnostic resource, for the study of general and internal conditions. He goes on to say that for thousands of years the pulse, felt in a little space at the wrist, was, by its variations in rate, in strength, in rhythm and quality, the convincing sign of disease, the basis of pathology and internal medicine. The doctor with his trained finger on the pulse became the oracle, proclaiming the future and prognosticating life and death. Minute particles, submitted to the exact methods of chemical research, or placed beneath the lenses of the microscope, have brought about the great extension of our knowledge and power that has characterized the development of modern medicine. The staining of thin sections, exact biologic experiments with minute proportions of toxins, antitoxins, opsonins and vitamins, have created our modern domain of diagnostic and therapeutic power. They have opened new windows through which we look into the workings of natural

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(2) Atlantic Med. Jour., December, 1923.

law, and one of these windows still almost unused and little understood or appreciated, is opened by the ophthalmoscope.

In the eye we have conditions and opportunities particularly favorable for the observation of changes in the living tissues; we have spread out before us samples of all the important general tissues of the body. It is a general law that to understand thoroughly a part, even a very minute part, is to understand the whole. Here we have epithelial, connective and nerve tissues, modified in the direction of transparency so that they transmit light in a way that lays open their secret processes and minute changes to sight, the most highly developed, exact and best-trained of our senses. We see here the development, migration and transformation cells. Edema, exudates, hemorrhage, come and go before our eyes, showing all stages of their cycles. The blood vessels of the body lie in full view, from complete trunks to capillary net-work, and the modifications of the blood, not as found after death, but as they exist during life while the blood is still performing its functions. We see the different lesions passing through the various phases of disease, to recovery or death.

All this may be watched under a most important and serviceable degree of magnification. The exact microscopist appreciates the value of the lower powers of his microscope; and the 10 to 20 diameters under which we see the tissues with the ordinary ophthalmoscope, are readily supplemented by lenses placed before the eye, as in the large fixed ophthalmoscope.

These opportunities were first used for the purpose of better understanding the ocular diseases—cataract, glaucoma, optic nerve atrophy, and the previously unknown lesions of the retina and choroid. Observations made with the ophthalmoscope are evidences of general processes that go on in similar tissues in all parts of the body; from which evidences, by the constancy of natural processes, the reliability of vital reactions, we may infer with great certainty the existence, character and progress of internal and general disease. From this point of view, ophthalmoscopy furnishes samples of lesions such as are characteristic of the pathologic process that is working elsewhere in the body. For instance, metastatic carcinoma in the choroid has furnished sufficient basis for a diagnosis, even when the primary tumor had not been recognized, and before it was possible to discover its existence or location by the other methods of diagnostic research now known.

Used for this purpose, it was natural that the ophthalmoscope should first bring to our attention general diseases of the vascular system and alterations in the circulation and character of the blood that are found in general disease. These changes were first well studied in connection with diseases marked by ocular lesions that caused impaired vision. From the early days of the ophthalmoscope, seventy years ago, the retinal changes found with chronic Bright's disease attracted attention and were carefully observed by many ophthalmoscopists. But it was only forty years later, when Marcus Gunn pointed out the vascular changes in the retina as significant of the lesions of angiosclerosis, such as develop in the blood vessels of all parts of the body, that their general significance began to be appreciated.

The blood vessels have the same function and the same general structure in every organ of the body. The vascular lesions observed in the eye are very similar to lesions that occur in the vessels of other organs. Even the variations between a terminal and an anastomotic circulation are open to ophthalmoscopic inspection, in the vessels of the retina and the choroid. Every vascular lesion known to general pathology is here available for minute study. Hyperemia, anemia, embolism, thrombosis, infarction, edema, hemorrhage, endo- and periarteritis, phlebitis, atheromatous and calcareous degeneration, general dilatation, aneurism, stenosis, the development of new vessels, their restoration or disappearance, are revealed to prolonged, repeated observations, not in the dead specimen, but in the living process through its whole course.

But these same vessels are capable of other variations, deliberately produced. One of the spontaneous variations is the pulsation, often seen in the veins in response to changes in venous blood pressure. The pulsation is due to the shifting of balance between the external pressure exerted on the wall of the vessel and the internal pressure, or resistance of the blood stream. When the former increases, the blood stream is narrowed or thinned; when the latter predominates, the vein becomes distended, thicker and broader. The balance between external and internal pressure can be modified by pressure on the exterior of the eyeball.

In 1911, Black, of Denver, called attention to the changes in appearances of the blood vessels on the optic disk that could be produced by pressure upon the eyeball with the tip of the finger through the lid, and to the important indications as to the condition of the vessel walls and the blood pressure that are shown by the amount of pressure that had to be exerted to produce such changes. Since then Bailliart has devised a pressure gauge, in which the pressure exerted is measured by the resistance of a spring and indicated by a scale on the side of the instrument. The method of using it is to anesthetize the eye with cocain, holocain or butyn, and press the end with the projecting point against the sclera, the pressure being exerted through the finger tip placed at the other end on the rod that acts against the spring. At the same time the observer looks into the eye with the ophthalmoscope and notes the effect produced. In learning to use it, one can practice steady, definite pressure and the reading of the instrument, by use of the device suggested by Magitot for testing the accuracy of its graduation and working—by pressure on an ordinary balance, such as may be found in any drug store.

With the pressure gauge, one can make a known, definite pressure on the eyeball. When this is added to the intraocular pressure, as ascertained with the tonometer, we know how much pressure is exerted on the retinal vessels to produce any particular effect. The pressure that just produces pulsation in a vein is just above the minimum intravenous pressure. The pressure that excludes the blood column from the vein is just above the maximum pressure in the vein. Similarly the pressure that causes visible pulsation in an artery has just overcome the diastolic arterial pressure; and the pressure that keeps the blood out of the artery, and thus stops pulsation, has overcome the systolic arterial pressure. That which causes the blanching of the general surface of the optic disc is what overcomes the capillary blood pressure.

Knowing, thus, the blood pressure in the retinal blood vessels, we can compare it with the blood pressure as usually taken in the brachial artery with the sphygmomanometer. From such comparison important facts are likely to be deduced. Already this very important deduction has been recorded. In cases of choked disk it is found that the retinal diastolic pressure is high as compared with the general diastolic pressure; although the retinal and general systolic pressures have the normal relation. But Magitot states that in a series of clinical cases it was found that even if there was no choking of the disk, with such relatively high diastolic retinal blood pressure there was always hypertension of the spinal fluid. And he gives a case in which the diagnosis based on this symptom was confirmed by spinal puncture. The study of retinal blood pressure is only just beginning and has thus far been taken up by but a few observers. It illustrates how little the diagnostic possibilities have yet been developed. But it may be noted that the method of measuring blood pressure by direct vision with the ophthalmoscope is probably quite as accurate as the method of measuring with the sphygmomanometer by the sound transmitted through the tissues of the arm, or the feeling of the pulse at the wrist, and its possibilities certainly rival those of the electrocardiograph.

The changes observed in the vessel walls and their pulsation, are not the only cases in which the retinal blood vessels, as seen with the ophthalmoscope, may give important aid for the diagnosis of general diseases. The color, shade and uniformity of the blood column within the vessel may all be very significant. The retina is embryologically, and probably functionally, a part of the central nervous system, spread out for inspection by the ophthalmoscope. The changes in the vessels of the retina are very suggestive of changes going on in the unseen vessels of the cerebrum, cerebellum, pons and medulla. But the color of the blood is very closely related to its composition, and any change in composition discoverable in the retina, is equally operative in every organ and tissue of the body.

In 1880, Dr. Albert G. Heyl, of Philadelphia, reported the changes in the color of the blood observed in the eye of a patient suffering from diabetes, to which he gave the name of intra-ocular lipemia. Since then about thirty cases have been reported in which this condition has been observed, most of which but not all, were diabetics; and such cases occur more frequently than has been supposed. Within a year more than a half dozen new cases have appeared in the literature of this country. Gray and Root pointed out last April that this peculiar color of the retinal vessels appeared when the blood held lipoids to the amount of 6 per cent and disappeared when they fell to 3 per cent.

This phase of ophthalmoscopic diagnosis illustrates two things: The fact that these questions are live questions, still to be decided, very much up-to-date; and also, the very intimate relation between ophthalmoscopic observation and laboratory findings.

This matter of the importance of the *color of the light* used for ophthalmoscopic examination, is only just beginning to be appreciated. When we shifted from the kerosene or gas flame to the early Welsbach mantles, the optic disk took on a pallor that suggested optic atrophy, and it required a reëducation in the significance of the color seen, before sound judgment could be reached regarding it. The variations in color of the light constitute one of the worst defects of the electric ophthalmoscope. The small lamps used quickly change in color, the light becoming more red as the lamp deteriorates; and the rheostat adjustment, to make the light brighter or dimmer, introduces endless confusion as to relative color values.

There is every probability that careful trial of light from other parts of the spectrum will bring to our knowledge other phenomena quite as important as any that have been revealed by the use of "red-free" light. Let us remember that the spectroscope applied to the stars has revealed, not only their chemical composition, but their rate of movement in the heavens. The heliospectrograph, using monochromatic light, has shown much of the constitution of the sun's atmosphere, the distribution of its clouds of calcium and hydrogen gas, and the working of electric force in its cyclones that cause the sun spots. Of the possibility of light transmitted from the interior of the eye revealing life processes not yet known, we cannot now form any conception. The examination of the ocular fundus by polarized light has been entered upon, and the determination of the chemical composition of certain crystals in the retina by this means has recently been reported.

The amount of information already stored in the literature of ophthalmoscopy is large. It is impossible to refer now to all parts of it with so much detail as has been given regarding studies of the retinal vessels. Among changes revealed to the first users of the ophthalmoscope were those of swelling and obscuration of the head of the optic nerve. But 70 years have not entirely cleared up the distinction between edema and inflammation, papilledema and optic neuritis. The work of our contemporaries, among whom de Schweinitz, Holloway and Walter Parker are well known to most of us, is doing much to bring order in the current literature of this subject; but the confusion in the older literature must remain a source of misapprehension and uncertainty for years to come. The observations of Benedict regarding the changes in the optic nerve head significant of pituitary disease seem to make a distinct advance in medical diagnosis with the ophthalmoscope, but they need confirmation.

The minute, repeated or daily study of slight changes in the optic disk and its immediate neighborhood, in their early stages, may yield evidence as to the seat and character of general disease, or disease of structures outside the eye but near to it, that will enable the experienced ophthalmoscopist to gain important information therefrom, even to be compared with the diagnostic information which the pediatrist or the dermatologist gets from examination of a skin eruption.

Remember the eruptions of smallpox and syphilis have been studied minutely for hundreds of years. But we rarely see the optic nerve lesions of mumps, chicken pox, typhoid fever, cerebrospinal fever or influenza, except in the few cases in which the process has gone on to optic atrophy and permanent impairment of vision. Thanks to the disturbing effect of diplopia we did get a chance to see early cases of epidemic meningitis; and in many communities the ophthalmoscopist first recognized not only transient changes in the optic nerve, but also the presence of this epidemic disease.

The retina is both a peripheral nerve ending and a part of the central nervous system, so different from any other part of the nervous system that its pathologic problems constitute a class by themselves. Very little light is thrown upon them from analogy with lesions in other parts of the body, and only functional and ophthalmscopic studies during life, followed by histologic study after removal from the body, can be expected to help as much to a better understanding of retinal disease, or the changes in it that are due to poisons, defective blood supplies, and the disorganizing influence of toxins or perverted endocrine substances. Improved methods of ophthalmoscopic examination, of which the use of monochromatic light is one of the most promising, seem to promise much in this direction.

In the eye the trunks and endings of general sensory nerves are to be studied in the cornea with the corneal microscope. Motor nerves and muscle cells are only available for ophthalmoscopic study in the arterial walls. But the iris offers a most inviting, promising, and fascinating field for their study. The connective tissues modified into various forms, some relatively transparent, others more opaque, present a wide range of ophthalmoscopic pictures.

From this sketch, suggesting possibilities for ophthalmoscopy in the broad field of medical diagnosis, let us turn for a moment to the question of practical interest. How are men to prepare themselves for original investigation in this direction, or to apply a knowledge of what has already been discovered? Two things are necessary: 1. A knowledge and understanding of the facts already known, and the storing and arrangement of them in the mind. 2. Most thorough training of the sense of sight and the powers of discrimination in the observation of what is revealed by the ophthalmoscope.

We sometimes urge upon the attention of men who are working in other branches of medicine the importance of symptoms and changes revealed by the ophthalmoscope and the value of becoming acquainted with this instrument. Internists, and especially neurologists use the instrument and quickly recognize a choked disk or an albuminuric retinitis, or the retinal arterial pulsation of aortic regurgitation. But if these have cases of beginning optic neuritis or doubtful change in the retinal vessels, they are the first to ask help in the diagnosis.

The full appreciation of the less obvious and striking ophthalmoscopic changes that enormously extend the field for ophthalmoscopic diagnosis, the pushing of investigation into the significance, the frequency of such changes, their reliability as diagnostic guides. and the indications they give for therapeutic measures, must all rest with those who have studied ophthalmoscopy long, persistently and intelligently, and who, by the widest reading concerning it and years of development of their skill as observers, have attained an exceptional mastery of the field ophthalmoscopy opens to us.

Drowsiness. According to J. A. Kearney,[3] drowsiness is one of the annoying symptoms often noted in a routine ophthalmological practice. Affections of the conjunctiva and marked reduction of vision in both eyes are usually the accompanying ocular conditions observed that account for this complaint. An existing uncorrected error of refraction *per se* is seldom found to be a factor in its production.

After eliminating present and past constitutional dyscrasias that may account for drowsiness, the problem is reduced to a solution of possible ocular factors contributing to it.

An unpolished or uneven surface of the palpebral conjunctiva is found to be the chief source of drowsiness,

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(3) Med. Jour. and Record, Mar. 5, 1924.

although the low grade catarrhal affections of this membrane are observed most frequently. The low grade catarrhal affections producing drowsiness seldom present any external evidence of disease, but by everting the lids, the conjunctiva appears dryer and redder than normal and upon close inspection the surface is studded with minute fine points. Occasionally, a low grade catarrhal affection of the palpebral conjunctiva has extended to the margins of the lids and by viewing the eyes externally, the margins appear redder than normal; a history of small hard crusts found at the inner canthi in the morning is usual when this condition obtains. Drowsiness usually disappears when the affected conjunctiva is polished by a course of treatments. Many patients who consult the ophthalmologist first hand attribute their drowsiness to eyestrain and feel that correcting glasses will remedy the trouble, but it is surprising to notice how few of such patients who complain of drowsiness of itself have any error of refraction when estimated under the effect of a cycloplegic.

Complaints of headaches combined with drowsiness are not uncommon. These symptoms will not disappear by wearing correcting glasses when they are found necessary, but will nearly always pass away by administering successful treatment to the affected conjunctiva additionally. Among the less frequent affections resulting in unpolished and uneven surfaces of the conjunctiva, are deeply seated calcareous deposits, overfilled meibomian ducts, chalazia, post results of trachoma, end processes of operations upon the lids, enlarged pinguecula, low grade scleritis and episcleritis, pterygia and neoplasms. Following the reduction of the above affections that had been accompanied by drowsiness, it was noted that this symptom usually disappeared. Drowsiness is a constant complaint when fully developed pterygia are present, but at this time we see very few of such cases in this locality.

Drowsiness is a frequent complaint when vision is markedly reduced in both eyes and unattended by pain in the eyes. The usual painless ocular affections that reduce vision in both eyes are: cataracts, optic atrophy, low grade optic neuritis, retinitis and choroiditis, degenerations in the fundi, and dyscrasias in the media.

Many who have had lenticular opacity, sufficient to reduce vision considerably in both eyes, suffer from excessive drowsiness and this symptom disappears following a successful extraction of a cataractous lens when good vision was obtained after the operation. Those who employ the eyes for continuous close work, apply most frequently for relief of drowsiness as they find it embarrassing and at times impossible to keep awake during working hours, although they are in good health, live regular lives and have plenty of natural sleep at night.

Where the Field of the Oculist Meets That of the Practitioner. Although such occasions may be comparatively rare, there are times when one doing general practice is consulted about some eye condition. Now and then will come one where the wrong treatment given or the needed treatment delayed may have unfortunate results. Practitioners are so nearly unanimous in protesting ignorance of the most elementary facts of ophthalmology, that it is not presuming too much to discuss here some of the things that must often be treated first by the family doctor.

B. Y. Alvis[4] reviews some of these conditions and recalls the signs by which the general practitioner can recognize them, some of the consequences of improper treatment or delay, and in some instances suggesting in a general way the course to be pursued.

There is perhaps no condition that brings more patients from the general practitioner to the oculist than headache, and eyestrain is often an unsuspected source of headache.

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(4) Illinois Med. Jour., April, 1923.

If the headache comes on after use of the eyes, *i. e.*, after the patient is up a while,—gets worse as the day goes on or on doing close work,—is better after going to bed, one should at once suspect eyestrain as the cause. The patient's vision may be perfect and no discomfort may be noted in the eyes themselves, although as a rule, eye discomfort accompanies all headaches. The headache may be frontal, occipital or across the vertex. It is usually bilateral.

A headache that is present on rising and gets better after the patient is up a while is rarely due to the eyes. Eye-headaches are practically always relieved by sleep.

Headaches of the migraine type may be induced by eyestrain and made less frequent by its relief but they are rarely cured by this means.

In cases of persistent headache one should never overlook the possibility of intracranial new growth nor forget that the eye examination furnishes a most important part of the evidence for the diagnosis.

The following case is an example:

A girl, aged 13, was suffering from headaches and dizziness, associated with vomiting. Recently, she had been seeing double and this symptom caused her to be sent to the oculist. Upon examination it was found that she had choked discs, weakness of abduction to the left, and the left blind spot was enlarged. Upon this basis she was referred to a neurologist, who confirmed the tentative diagnosis of brain tumor. At operation the tumor was removed and the girl is now apparently well. Such cases are not so rare as one may think and it is generally the family doctor who is first consulted.

Among other causes of headache *acute glaucoma* is to be considered. There are several conditions where there is unilateral pain in the head, and in the eye and back of it. Since ophthalmic migraine, neuralgia of the face, frontal or ethmoidal sinusitis, besides some other eye conditions as panophthalmitis and iritis may present a similar picture, one may simply overlook the glaucoma by not suspecting it.

The differentiation is readily made by the large fixed pupil, the cloudy cornea, the poor vision and the hardness of the globe. Each of the other conditions also has its own characteristic signs.

A few months ago a man, aged 50, came to a physician with a foreign body on the cornea which had been there several days and had caused considerable inflammation. The foreign body was removed and because of the considerable pain and circumcorneal redness a drop of atropin was instilled. Early next morning the patient was seen at his house suffering terrible pain in and behind this eye. Here was no question that the eye was the seat of the trouble. There were, however, two horns to the dilemma. The history of injury and delay in treatment suggseted an inflammation, perhaps an iritis, as that would have given severe pain, aching and redness. If an iritis, the treatment would be atropin to dilate the pupil, if glaucoma, atropin would make it much worse. Examination of the eye showed a large fixed pupil, a cloudy cornea, and swollen orbital tissues. The globe was much harder than the other eye but so tender that palpation was difficult. Here the differentiation depended almost entirely on the increased hardness of the globe as the large pupil could have been due to the atropin previously instilled and the cloudy cornea might have been seen in an inflammatory condition. Such a mistake in diagnosis and continued use of atropin would have indeed been a grievous error and would probably have cost the patient his eye sight in a very few days. The use of 1 per cent eserine solution every few hours and applications of hot towels gave relief of the pain and eventually the vision was recovered.

Chronic glaucoma is not nearly so striking and is not so often treated or seen by the general practitioner. This disease alone would be reason enough for barring the fitting of glasses by optometrists. Practically every oculist has each year one or more cases similar to the following:

Mrs. W. had always bought her glasses at a certain optical shop where they were fitted *free by a licensed "doctor of optometry."* She was getting old, however, and could no longer see so well. She noticed that there was a halo about the lights and that she stumbled over articles about the house, so she had her glasses changed. This change was not satisfactory, so she changed opticians and another optometrist sold her another pair of glasses. These also helped but little, and a third "specialist" was seen. He found that she could see practically nothing with one eye and very little with the other and advised her to seek the advice of an oculist as she probably had cataracts. Unfortunately she did not have catarcats. The wide fixed pupils, the slightly clouded cornea and the eyes fixed ahead suggested what the measure of the tension confirmed—chronic simple glaucoma, neglected; the sight hopelessly lost.

Acute iritis not infrequently causes a patient to seek his family doctor for a "sore eye." The doctor perhaps feels that this is not an ordinary case, but not being sure gives it expectant treatment a while before sending it to an oculist. In this short while considerable damage may be done.

Perhaps the thing that most often calls the family doctor into the field of oculist is the eye injury and in no circumstance is there greater need for good judgment. In spite of the fact that most such injuries are trivial and lead to no permanent disability nevertheless they are usually considered with concern by the patient and his family. This almost universal fear of eye injuries is without question based upon the generally known fact that many such apparently slight injuries end disastrously. The patient and his family may feel very confident no serious damage is done, but they feel incompetent to judge, so see the doctor for assurance. And their fears should not be too lightly allayed.

Every advantage lies with the case that is seen early. In these cases the first but not infallible guide is the vision. If normal there probably is no serious injury, but one must not be too sure.

Eyes that have been struck by a blunt object as a ball or a fist may be brought for opinion. If the vision is normal and the pupil active and equal to its fellow there is usually little to be feared even if the ecchymosis and swellings are extensive. One cannot be absolutely sure without ophthalmoscopic examination of the fundus but one may be reasonably assured.

Foreign bodies on the cornea are often overlooked. If a patient says he has something in his eye do not be sure he hasn't until a most careful examination with focal light has been made.

After finding the offending particle use first a small piece of cotton wrapped tightly on a small applicator to remove it. If it cannot be brushed off then take a fine pointed instrument and remove the foreign body with as little else as possible.

After removing foreign bodies a small abrasion of the cornea usually remains and when an abrasion exists a dressing should keep the eye closed until it is healed. In such cases the use of a solution of fluorescin, 2 per cent., or mercurochrome, 1 per cent., is most useful in showing whether the epithelium has covered the wound.

After severe irritation of the eyes as by smoke, or by ether during anesthesia the first requirement is to relieve the pain.

First aid in the case of lime or acid burn of the eye is most important and proper instruction by telephone may save the eye. The first thing to do is to get the offending substance out of the eye and the best means is to flush with plenty of water. A very good way is simply to hold the eye under the faucet and let the water run through. If an acid burn, and soda is at hand and can be applied at once, very well, but don't wait—wash it out.

The electric or self luminous ophthalmoscope is so easy to use that no one need feel it too difficult. A very moderate amount of practice will render one capable of observing the disc and judging whether there is blurring or swelling of the nerve head; or one can see many of the changes that accompany constitutional diseases as diabetes and nephritis.

The pupils are certainly worthy a moment's consideration. Every patient, especially every one at middle age and above, deserves a careful observation of his pupils as to size, shape, equality and reaction to light and accommodation. This is indeed an oft repeated statement but nevertheless the Argyll Robertson pupil is too often first observed by the oculist.

Another reaction, not so well known as it deserves to be, was first described some years ago by Drs. Wolfner and Wiener. It is a reaction seen in cases of arteriosclerosis with hypertension. The pupil is large, reacts promptly to light, but at once rebounds to its former size or nearly so. The sign may hardly be considered pathognomonic of hypertension, but it is certainly suggestive and hypertension is found in most cases exhibiting it.

In presenting this incomplete discussion of so many rather unrelated subjects, the author's purpose has been to combat the feeling harbored by so many physicians that eye conditions are in a class with Einstein's theory, hence not to be considered by them; also to show that the general practitioner not only can know many eye diseases in their essentials, but that the patient has a right to expect him to know them well enough at least to be able to judge whether they are serious or not; whether they require immediate attention or can wait; and finally whether it is necessary to consult an oculist. This latter idea may cost the oculist some practice. It is nevertheless a service the patient has a right to expect from his tried friend, the family doctor.

CONGENITAL ANOMALIES

Congenital Cornea Plana. The recognized clinical picture of cornea plana, although a rare condition, is a distinct clinical entity, which has been well described by Friede. However, a review of the literature shows it to have been confused in some instances with microcornea.

The following case, as described by W. E. Swett[5], was that of a small orphan boy, seven years of age, who was examined for the complaint of poor vision, and on examination both corneas were found to be flat, oval and so unusual in appearance, that further investigation was indicated.

The boy was living at the time in a foster home and knew nothing of his real parents. All efforts through his orphanage, foster parents and Children's Welfare Association failed to give any information regarding the past history of his parents, so the family history is wanting. A complete physical examination revealed no other malformation than the cornea plana and a 5° internal strabismus of the left eye.

The following description applies to both eyes. The most noticeable gross abnormality was the flatness of the whole frontal section of the globe with its small vertically oval cornea, which appeared flattened as though the iris were directly against the posterior surface. There was no distinct limbus, the white of the sclera gradually fading into bluish-gray, thence into the transparent cornea with no sharp line of demarcation, and the curvature of the cornea being continuous with that of the flattened anterior section of the globe.

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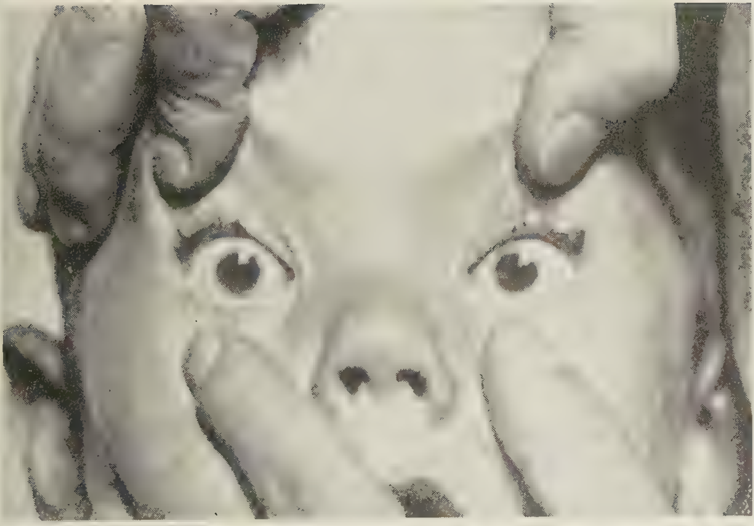
(5) Amer. Jour. Ophth., June, 1924.

PLATE II.



Cornea plana. Note small size of transparent portion of cornea; and the shape, position and size of the high lights on the cornea.—Swett, page 32.

The globes were measured with calipers and found to be of normal size. The corneas were vertically oval and in reality larger than they appeared, the apparent smallness of the transparent portions being caused by the irregular over-reaching of the limbus. The transparent portion of the corneae measured 9.5 mm. in the horizontal and 10.5 mm. in the vertical.

This delicate over-reaching limbus involved the conjunctiva, episclera and superficial layers of the sclera; and projected into the corneal tissue forming an indefinite, irregular margin, varying from .5 mm. to 1.0 mm. in width. However, this zone cast no shadow on the iris.

The fine marginal capillary loops penetrated these parenchymatous stripes and melted toward the transparent portion, but at the limbus, there was a definite increased vascular development. The corneal microscope revealed many small linear grayish dots, in the transparent portion, similar to those seen in the nebulous marginal zone, and probably of the same tissue.

The fact that the cornea was larger than it clinically appeared was demonstrated by transillumination and oblique illumination. The normal cornea has a horizontal diameter of 12 mm., and a vertical of 11 mm. Measurement of the cornea in this case by using the iris angle by the above method gave the horizontal diameter 10.5 mm. and the vertical 11.5 mm. which approximate the normal dimensions.

As a result of the marked flattening of the cornea, the reflex image of the window covered most of the corneal surface and extended unbroken across the limbus onto the neighboring sclera. This phenomenon is well shown by the form of the high-light in the photograph, which will be seen to extend from the scleral surface to the center of the cornea, without any break or deformity of the image at the limbus. It will be noticed that it is broader than normal, especially the corneal end, which is broad and indefinite, rather than sharp and pointed, as would be expected on a flat surface.

The anterior chamber was so shallow that the iris appeared to be in contact with the posterior surface of the cornea, and the iris angle was wider than normal due to the overlapping marginal zone. The iris and lens were normal in appearance and position, so that the extreme shallowness of the anterior chamber was due to the flatness of the cornea, and not to an abnormal curvature forward of these parts. (Plate II.)

Careful examination of the fundus, lens and vitreous under a mydriatic proved these to be normal in every respect.

Measurement of the corneal refraction by means of the Javal was difficult, due to the flatness of the corneas, so that the step images were very distorted and approximated with difficulty. The approximate readings were:

Right: horizontal 34 D., vertical 33 D., Left: horizontal 34 D., vertical 34-35 D.

Corneal Radius: Right 11 mm., Left 11 mm.

The total refractive error found by retinoscopy was +9.50 at 90° and +10.0 at 180°.

Vision: Right: 20/200, +6.50 Sph.=20/40; left: 10/200, +7.0 Sph.=20/70.

Tension: Right 40 mm., left 36 mm. (McLean Tonometer).

The tension taken with the fingers was full and equal; the information derived in this way seemed more reliable than the tonometer readings owing to the nonconformity of the footplate to the flat corneal surface.

The visual fields were normal for white, but the test for color fields could not be taken with precision, because of the boy's age. However, the color sense was normal. Wassermann: Negative.

Rübel described this congenital anomaly in three brothers as follows: "There is a noticeable flattening of the anterior bulbus section and of the cornea. The curvature of the cornea goes over into the bordering sclera without forming an angle. The delicate parenchymatous cloudiness which extends into the transparent cornea has an undefined, irregular line of demarcation, and gives the cornea the approximate shape of a flat oval. The limbus is more or less strongly vascular; however, the development of the vessels reaches only a short distance, or not at all into the corneal tissue. The anterior chamber is shallow, the angle is arched over by the sclera. The iris is poorly developed but reacts normally. The lens, vitreous and fundus normal in all cases.''

The three cases were summarized as follows:

Diameter of cornea: 8 to 9.5 mm.

Corneal refraction: 23 D. to 32 D.

Corneal radius: 10 to 12 mm.

Total refraction: 3 D. to 7 D. Hypermetropia.

The constant recurring findings are the smallness and flatness of the cornea and the reaching over of the limbus onto the cornea. This peripheral cloudy, or parenchymatous zone, is milky white in color and gives the impression that the sclera is continued onto the cornea.

Von Hippel and Rübel found this delicate parenchymatous cloudiness to be similar to the sclera in structure, and could find no cause for the condition other than a congenital anomaly.

Corneal plana seems to be a stationary condition since a later increase or decrease in the curvature has never been noticed.

The following table is useful in differentiating cornea plana and microcornea:

Cornea Plana.

1. Abnormal flatness.
2. Poorly defined limbus.
3. Corneal refraction, average 28-35 D.
4. Corneal radius: 10 mm.
5. Total refraction: +7.0 D.
6. Normal formed or enlarged bulbus.
7. Malformation of the anterior segment and limbus.

MICROCORNEA.

1. Increased or normal corneal curvature.
2. Normal, clearly placed limbus.
3. Average 46 D.
4. 7.3 mm.
5. —2 D. up to +18 D.
6. Microphthalmic.
7. Malformation of the entire globe, limbus normal in shape.

Some Congenital Anomalies of the Eye, and their Confusion with Acquired Conditions. The eye, in common with the rest of the body, is not exempt from the liability to occasional imperfect or aberrant development, with this difference, however, that whereas congenital malformations in other parts, such, for instance, as harelip, spina bifida, or imperforate anus, are usually self-evident as errors of development and easily diagnosable, the lesser abnormalities of the eye may sometimes closely simulate pathological states. Failure to recognize their congenital origin may thus lead to misapprehension and in some cases to much unnecessary anxiety on the part of the practioner. This apparent difference is no doubt partly due to the ease and minuteness with which the eye can be examined, so that less degrees of departure from the normal will be recognised in the eye than is possible in other parts, and partly to the fact that, the defects being in many cases invisible without an ophthalmoscope, they escape the notice of the patient or his relatives until discovered by examination.

Naturally, as in other parts, there are also gross errors of development of the eye which are immediately evident at birth (such as microphthalmia, crytophthalmia, and cyclopia). These do not require description here, since they are obviously developmental and are unlikely to be confused with anything else or to demand treatment. Ida Mann[6] calls attention to some of the smaller anomalies which may easily be confused with pathological conditions of grave import.

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(6) Lancet, Apr. 14, 1923.

Differential Diagnosis of Congenital Abnormalities from Affections of the Fundus Oculi. Affections of the fundus will be dealt with first, since they present by far the most difficult diagnostic problems.

From Papillœdema. A young patient may come to his doctor complaining of increasing headache, irritability, and inability to concentrate on work. In the course of the examination, which reveals no definite physical signs, the eyes are inspected. There is no external abnormality and the patient states that his vision has been good, but that lately he has noticed occasional mistiness. On ophthalmoscopic examination it is seen that the edges of the optic disc are blurred and that it is distinctly redder than normal. The question at once arises as to whether this is a case of early papillœdema from cerebral tumor, and this diagnosis may easily be made if one forgets the existence of the congenital condition known as pseudo-neuritis.

Pseudo-neuritis is generally associated with hypermetropia, sometimes of high degree (6 D. or more), but not necessarily. This hypermetropia will give rise to severe headache, blurring of vision on close work, lassitude, and the whole train of symptoms of asthenopia, which, when taken in conjunction with an apparent early papillœdema may easily simulate signs of raised intracranial pressure. The differential diagnosis rests on the following facts: Pseudo-neuritis is almost invariably associated with hypermetropia. The swelling of the disc is more apparent than real. There are no hemorrhages and no exudate. The appearance is absolutely stationary and the symptoms can be completely relieved by correcting the hypermetropia. A cerebral tumour sufficiently advanced to cause papillœdema will almost certainly have given rise to vomiting as well as headaches. However, a swelling of two dioptres or more is certainly pathological and pseudo-neuritis should not be diagnosed.

One should bear in mind in considering the diagnosis of papillœdema the fact that apparent blurring of the upper and lower edges of the disc is often seen in high degrees of astigmatism and is merely an optical effect caused by the impossibility of focusing all parts of the disc distinctly at the same time. As regards the color of the disc, it should be remembered that it is very variable, normal degrees of vascularity shading imperceptibly into states of definite hyperemia. Generally dark complexioned people have discs of richer color than blondes. The very variable pigment ring round the disc should not be mistaken for a pathological condition.

From Glaucoma. Another and rarer condition of the disc may cause anxiety by confusion with the cup seen in chronic glaucoma. In the true glaucomatous cup the vessels can be faintly seen emerging from the centre of the disc at the bottom of the cup and curling over the overhanging edge, while the field of vision shows contraction, especially on the nasal side, though central vision may be of normal acuity. In the congenital condition which resembles this all the vessels emerge round the edge of the disc and no central vessels can be seen. Sometimes the surface of the disc is level and sometimes deeply depressed below the surface of the retina (coloboma of the disc), in which case the appearance much resembles a glaucoma cup, but is often much deeper and more irregular, and may show pigmentary deposits. It is interesting to note that a cup disc with vessels emerging round the periphery is normal among most of the carnivora. The visual acuity in these congenital cases may be normal or diminished. An abnormally deep physiological cup will not be confused with a glaucoma cup if it be remembered that in glaucoma the margin of the cup is at the margin of the disc (though the disc may be surrounded by a white ring of exposed sclera), while in a deep physiological cup there is always a rim of normal disc round the periphery.

From Glioma Retina. One is often confronted with infants brought because the mother fancies there is something wrong with the child's eyes. She may even have noticed a peculair sheen in the pupil. Other conditions besides glioma of the retina should then be borne in mind. The congenital conditions most likely to cause doubt are the various degrees of persistent hyaloid artery. In well-marked cases a vessel stretches through the vitreous from the optic disc to the posterior surface of the lens. Here it may appear only as a small central opacity in the pupil, or it may be associated with persistence of the posterior part of the vascular çapsule of the lens, in which case the back of the lens will be seen covered with a more or less shining membrane in which blood-vessels can be seen. This appearance much resembles a mass of vascular new growth in the vitreous, but it must be remembered that in glioma retinæ the tension in the posterior part of the eye is increased and the lens and iris pushed forwards, so that the anterior chamber is very shallow, while in persistent hyaloid artery the anterior chamber is normal or even deeper than normal.

In less marked cases the posterior part of the lens is unaffected and only the proximal part of the artery persists. It may be seen as a cord-like structure stretching forward from the disc, sometimes containing blood and sometimes veiled with a film of connective tissue, which may also extend over the branches of the *Arteria centralis retinæ* on the disc. This appearance may resemble a new growth, but it lacks the golden and clear-cut appearance of early glioma and there are no satellite growths scattered over the retina. It is a point of anatomical interest that the hyaloid artery normally breaks up into several branches in the vitreous before reaching the lens. In two human embryos examined, there were five branches spreading out in a fan from the main trunk. If more than one of these branches persists the condition may be mistaken for *retinitis proliferans*.

From Retinitis and Choriditis. The diagnosis and prognosis of general conditions, particularly those associated with arterio-sclerosis, albuminuria, or syphilis, are often materially assisted by an examination of the *fundus oculi.* In such cases the physician is particularly on the look-out for hemorrhages, white patches of exudate, pigmentary disturbances and areas of choroidal atrophy. Here, again, congenital defect sets a snare for the unwary. In the first place, the presence of *opaque nerve fibres* either at the edges of the disc or in patches along the course of the larger vessels may be extremely misleading. Unless excessive they cause no symptoms, so no help can be derived from the history. In appearance they are feathery white finely-striated patches of varying size, always with a fringed appearance at their peripheral edges. There is no disturbance of the retina apart from them and the vessels are usually normal, though, of course, arterio-sclerosis may coexist. They are very likely to be mistaken for patches of exudate, though these latter are always more creamy in tint, soft and fluffy in texture, and show no peripheral straition. They may frequently be seen to involve the deeper layers of the retina, whereas opaque nerve fibres are superficial. Exudate is almost always associated with hæmorrhages and changes in the vessels and is often accompanied by a "macular fan," while it is rare for opaque nerve fibres to involve the macula, and if they do so it is in the form of a dense white patch and not a fan-shaped figure.

Hemorrhages from the retinal vessels are usually quite straightforward, but there is a curious and rare condition which may be confused with them. This anatomical peculiarity is known as a choroido-vaginal vein (or posterior vortex vein). Such a vessel is a very large choroidal vein and which collects blood from a variable area of the choroid and leaves the eye in the neighbourhood of the optic disc. It is very broad (sometimes as much as half the diameter of the disc) and lies on a deeper plane than the retinal vessels. Like the smaller choroidal vessels which are sometimes visible it has no light streak, but is flat, lustreless, and ribbon-like. Its large size, deep red color, and lack of reflex make it look very like a patch of extravasated blood, but if it be examined carefully it will be seen to be a large vessel, and pressure on the eyeball will cause it to empty and disappear. Such choroido-vaginal veins occur most often in myopes, though they have been seen in poorly pigmented emmetropic and hypermetropic eyes. They sometimes leave the eye through the floor of a myopic crescent.

Patches of *choroiditis* are often of great diagnostic importance. They appear, unless seen early in the active stage, as glistening white areas surrounded by irregular heapings of black pigment. The retinal vessels often pass over them, but choroidal vessels are absent. The patches are usually multiple and vary in shape and size. Confusion may arise between patches of atrophy from choroiditis and one or other of the forms of *congenital coloboma of the choroid.* In coloboma the chorio-capillaris is absent over a portion of the fundus. Both choroidal and retinal vessels may been seen coursing over the white floor of the coloboma. They are usually small. The coloboma may be ectatic; patches of choroiditis, except in high myopia, are level or nearly so. Scattered pigment may be present or there may be a thin line of pigment at the edge of the coloboma, but there is not the exuberant heaping up of pigment seen in choroiditis. In coloboma there is only one patch and it is most often situated below the disc, with its greatest diameter in the vertical. Its anterior edge is frequently not seen, though it may reach to the edge of the pupil, constituting a coloboma of the iris.

Colobomata may occur in atypical situations and hence be misleading. The most important of these is the macular coloboma, which is rare and somewhat of an embryological puzzle. It much resembles a single patch of central choroiditis. It is usually horizontally oval, the edges are sharp, it is often surrounded by a yellowish zone, and it may be pigmented. There may be a history of defective vision from birth but not necessarily, and it may occasionally be extremely hard to diagnose. The chief features are that it is absolutely stationary and it is the only patch seen. The so-called Fuch's coloboma is a white crescentic area below the disc and is due to an anomaly of development of the upper end of the choroidal fissure. It is usually found in hypermetropic eyes and is not likely to be mistaken for anything else unless its white color and the patient's poor visual acuity (from the refractive error) lead to a suspicion of atrophy.

Pigmentary Disturbances. These occur with frequency in choroiditis, retinitis, and high myopia. Congenital anomalies of pigmentation may be either in the direction of excess or deficiency. The variable pigmentation at the edge of the disc has been referred to above. Pigment in this situation, even when in isolated masses, is seldom pathological unless accompanied by signs of exudate or choroidal strophy. The amount of pigmentation seen over the retina varies with the complexion of the individual, from almost chocolate color of the negro's fundus to the bright red apparently pigment-free albinotic eye.

On the whole, then, the differential diagnosis of intraocular congenital anomalies rests on the observation of minute details of their structure and color and to a certain extent on the appreciation of their stationary nature, though it is often undesirable to postpone an opinion until this last point has been verified.

Differential Diagnosis of Anomalies of Parts Anterior to the Vitreous. Anomalies of the parts of the eye anterior to the vitreous are also apt to give rise to difficulty, though on the whole their congenital nature is more obvious, both because the history is of some value and the parts concerned are more easily examined.

From Iritis. The chief signs of old iritis mischief which may lead to confusion with congenital conditions are the irregularity of the pupil, the presence of organised exudate and adhesions to the anterior capsule of the lens, and the alteration in color of the affected eye as compared with the other in unilateral cases.

Irregularity of the Pupil. In the first place, one must mention the condition of coloboma of the iris. Here the pupil is pear-shaped or oval with the narrower part usually below, though not always. The defect may be complete—i. e., a forward continuation of a coloboma of the choroid, or incomplete and not extending to the root of the iris or there may be a narrow bridge of iris uniting the two margins of the cleft at one point. Here the possible occurrence of fundus abnormality, the absence of adhesion of the iris to the lens, and the dilatation of the pupil under atropine and, if one may use a paradox, the regular irregularity of its shape, will assist the diagnosis.

In other cases the congenital malformation of the iris may take the form of extra holes beside the pupil, which itself may be abnormal in shape (polycoria). There is most frequently one extra hole near the pupil, the slender bridge of iris separating it sometimes resembling a band of organised exudate subdividing a normal pupil. Here a drop of atropine will help matters. In polycoria the primary pupil dilates and the accessory one merely alters in shape passively since it possesses no sphincter. In iritis with a bandlike adhesion both the parts of the pupil will dilate except where they are held by the adhesion. A single pupil may sometimes be seen much displaced, usually up and in (corectopia). Here the light reaction is normal.

True *adhesions* of the *iris* to the anterior capsule of the lens may occasionally be found in cases of polycoria and corectopia. More commonly, however, they are simulated by tags of persistent pupillary membrane. These may vary from fine filaments scarcely visible to fairly dense bands crossing the pupil and sometimes passing forward to the back of the cornea. Their true nature can always be recognised by observing that they are attached to the anterior surface of the iris a little way from the margin (the *circulus iridis minor*), whereas inflammatory synechiæ always come from the edge of the pupil. Occasionally these tags of persistent pupillary membrane disappear during childhood, but leave behind them a very regular arrangement of brown pigment dots on the front of the lens. These differ from the pigment spots left by broken-down inflammatory synechiæ in their regularity and small size.

Congenital *heterochromia iridis* is occasionally seen, either one iris being of a different colour from the other or different parts of the same iris varying in tint. The absence of signs of inflammation and atrophy will be noted.

From Results of Trauma. Some of the above conditions may also resemble the results of trauma. Coloboma of the upper or lower lid may occur in the form of a small notch, usually to the inner side of the mid-line of the eye. The eyelashes are absent in the coloboma. These defects in the lower lid are frequently associated with defective development of the malar bone. Various other anomalies, such as dermoids, skin bridges from the lids to the globe, coloboma of the iris, corneal opacities, etc., are often associated with congenital clefts of the lids.

The presence of corneal opacities must not be taken as absolute evidence of past inflammation or trauma since they may be congenital. The question as to whether they are truly developmental or are due to intra-uterine inflammation or trauma is debatable.

Coloboma of the lens may or may not be associated with coloboma of the iris. If it is not and the patient happens to come with a history of injury, it is possible that the edge of the coloboma seen in the pupil may be mistaken for the edge of a dislocated normal lens: it is to be remarked, however, that the curve of the edge of a colobomatous lens is concave towards the pupil margin while that of a dislocated lens is convex. A congenitally dislocated lens may be very misleading in this connexion, though the history of poor vision from birth may help. Congenital dislocation of the lens appears to predispose to acute glaucoma.

From Disorders of the Motor Mechanism of the Eye. In this group are included those congenital conditions which simulate on the one hand acquired disease of the central nervous system, and on the other the common condition of concomitant squint.

Congenital ptosis may be unilateral or bilateral. It is often incomplete, the pupil being not quite covered. In slight cases the lids may show movements associated with those of mastication and deglutition (synkinesis), but no independent movement. In more marked cases there is defective upward movement of the eye. In all cases of congenital ptosis the pupil reactions and the accommodation are normal, and this fact is perhaps the most important in their diagnosis. Confusion may arise in cases seen apropos of other non-associated symptoms, where the history is vague. In these cases one has to think of the possibility of a syphilitic syndrome, or of myasthenia gravis, incipient bulbar palsy, cerebral tumour, or abscess. The fact that one eye only is affected does not in itself exclude early myasthenia gravis.

In practically every other condition which may be confused with congenital ptosis there is involvement of some or all of the other muscles supplied by the third nerve, and the pupil reactions are invariably affected. In cases of congenital ptosis which are hereditary there is usually marked limitation of movement of the globe and also sometimes nystagmus, but in all the cases so far reported pupil reactions and accommodation were normal.

Congenital defect of any one of the eye movements may occur alone, and in these cases the defect may be due to various anatomical causes, such as defective development of the muscle at fault, its abnormal insertion or bifurcation, and absence or aplasia of the nerve.

The resulting squint can be differentiated from a concomitant squint by the fact that the relation of the visual axes to each other is not the same in all positions of the eye, and from a true paralytic squint by the absence of secondary contracture and of diplopia, and, frequently, the presence of nystagmus.

Inequality of the pupils is often a valuable diagnostic sign, but it should be remembered that it may accompany marked dissimilarity in the refraction of the two eyes. In these cases it varies from time to time, and becomes less when the correcting glasses are worn.

Nystagmus dating from birth is associated with some defect of the eye which hinders the development of central fixation. Such defects should be carefully looked for in considering all cases of nystagmus. The commonest are opacities in the media (especially the lens and the cornea, either congenital or due to ophthalmia neonatorum), albinism, and occasionally complete color blindness or aniridia. The presence of any of these will help to allay suspicions of disseminated sclerosis, cerebellar lesions, or Friedreich's ataxia. Congenital nystagmus is not accompanied by the sensation of movement of objects looked at and of vertigo, whereas acquired nystagmus frequently is.

From Melanotic Sarcoma. There are two conditions which may give rise to grave suspicions of melanotic sarcoma if they are accidentally discovered during a routine examination. They cause no symptoms, but neither does an early sarcoma. The first of these is the presence of clusters of small deeply pigmented nodules at the edge of the iris. They are sometimes likened to bunches of grapes (Traubenkörner) and are of normal occurrence in horses. Their position and the fact that they do not appear to infiltrate the iris but rather hang from its edge may help to distinguish them.

The second condition consists of the presence of one or more small black dots in or just under the conjunctiva, often at the site of perforation of the anterior ciliary vessels. A faint dusky patch is often seen here in dark-complexioned people, but occasionally a definite black nodule is formed, these should always be carefully watched, since, though, like ''moles'' elsewhere, they may remain quiescent permanently, there is always just a possibility that they may enlarge, when they must be viewed with suspicion and submitted to treatment.

Other Congenital Conditions of Interest. There are two conditions dating from birth which are interesting as they resemble senile changes, though they are of little diagnostic importance. The first is the presence of a white ring-like opacity in the cornea exactly resembling an *arcus senilis.* The second is congenital ectropion of the lower lid. This occasionally resembles the senile condition but may look like scarring. Ectropion of the lower lid is normal in St. Bernard dogs. The opposite condition—namely, entropion of the lids—is sometimes seen to occur congenitally. It is, of course, liable on superficial examination to be mistaken for trachoma, but the absence of granules or scars on the tarsal plate will distinguish it, even in the presence of pannus which may be caused by the rubbing of the lashes against the cornea.

Finally, there is a misleading condition of which the author recently saw a good example· The patient, a woman, appeared to have a marked unilateral exophthalmos which suggested the presence of an orbital tumour. On examination, however, it was found that the appearance of the exophthalmos was solely due to the large size of the affected eye, which showed a refraction of minus 16 D., the other being practically emmetropic. The media in both eyes were quite clear and the corneæ of the same size, there being no suggestion of buphthalmos. The patient stated that the condition dated from birth and that several other members of her family were similarly affected.

REFRACTION.

Refraction and Accommodation. In a lecture upon an ophthalmic subject, which would be of the most practical interest to the general practitioner, T. Harrison Butler[7] chose for his subject, "Refraction," because, as he says, there is no reason why much of this work should not be undertaken by the general practitioner to the advantage of himself and his patient. If he decide to take up refraction he must adopt modern methods and learn retinoscopy.

Refraction cannot be learned from books, and retinoscopy demands considerable practice. Probably the average man will require three months' constant work in an eye clinic before he attains the necessary accuracy. This period will not be wasted, for both from the standpoint of diagnosis and treatment a working knowledge of ophthalmology, not excluding refraction, is indispensable to the up-to-date physician.

The object of refraction is to make the patient comfortable, not the solution of a problem in optics. Glasses are prescribed to enable an individual to see clearly, and to relieve symptoms caused by errors of refraction and of muscle balance. It does not follow that spectacles which accurately correct an error will be comfortable; on the contrary, a man may prefer indifferent vision to wearing glasses which he dislikes. In cases of this kind we must temper our desire for optical perfection with common sense. If our patient is quite satisfied with his moderate acuity, and does not suffer from the symptoms of an error of refraction, then he may, if an adult, choose for himself when he will wear his spectacles. We prescribe the glasses to be worn when he wishes for clear vision, and we attain our object, which is to make him

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(7) Brit. Med. Jour., May 19, 1923.

physically and psychically comfortable. In the case of a child the conditions are different, and we allow no such latitude. An infant with poor acuity will grow up with unsocial habits and will not develop the habit of observation. He must wear his spectacles constantly.

The chief and obvious symptom is failure to attain to the normal standard of acuity. In actual practice for all ordinary work 6/12 is sufficient, so if the acuity is 6/12 or better, glasses are not called for in the absence of symptoms due to an error of refraction.

Headache is the next commonest symptom. In every case of headache the eyes should be examined both for refraction error and for disturbance of the normal muscle balance. It does not follow that a refractive error is the cause of the headache nor that its correction will cure the headache. If the spectacles have no favorable influence upon the pain, and if the acuity be good without them, then there is no necessity to wear them. Many men and most women object to wearing glasses, and if they are of no use there is no valid reason for employing them. Headache may be due to migraine, to nasal sinusitis, and to many other causes, which may coincide with an error of refraction which is not responsible for the pain.

The degree of error is not proportional to the trouble it causes. In one individual a considerable amount of astigmatism may cause no symptoms, whereas another may suffer agonies from a minimal defect. There are some who possess an abnormal visual acuity—they may be able to read all the letters in the 6/3 line. Such are very prone to be inconvenienced by a trivial refractional error. Others, with a highly excitable nervous system, may be relieved from lifelong misery by a 0.25 cylinder. We must not, however, allow exceptional cases of this kind to pervert our judgment; in young persons slight astigmatism with the so-called rule, and in the aged against it, is so common that it may be taken as normal, and in most cases causes no symptoms.

Pain in and about the eyes is, after headache, the most frequent complaint. This may be, and in fact often is, due to an abnormality in refraction or muscle balance, but it can be a pure neuralgia. Countless women complain of ocular neuralgia, often associated with pain elsewhere; intercostal neuralgia, brachialgia, coccygodynia, sciatica, and dysmenorrhoea—such are not in the main relieved by glasses; the pain must be treated along ordinary medical lines, generally with scant success.

Vertigo is one of the rare symptoms. It may be caused by muscle imbalance, especially by a high degree of hyperphoria, but the large majority of those who come complaining of giddiness have, if young, been suffering from an aural trouble, and if aged, from circulatory disturbances in the brain.

The essential symptoms of an error of refraction or of muscle balance are: poor acuity, headache, asthenopia, and very occasionally vertigo; but a host of others have been associated with these defects; in fact our American colleagues have given a long list of nervous and even of more general affections which they have treated by correcting errors of refraction. In this connection we must steer a middle course and not allow enthusiasm to blind common sense. It is doubtless true that an individual of highly neuropathic habit may suffer in various ways from the constant strain of an uncorrected error of refraction, and it is a fact that such may derive benefit from wearing spectacles, at any rate for a time—in some cases from relief of strain, in others from pure suggestion; but, on the other hand, the extravagant lengths reached by some regarding the effects of eyestrain have given rise to much confusion of thought and to not a little frank charlatanism.

The only satisfactory objective method of determining an error of refraction is by retinoscopy; it is the Alpha and Omega of refraction, and a man who is incapable of accurate retinoscopy will never achieve much success in refraction. Accuracy can be attained only by long and constant practice, but much may be done by attention to detail.

The apparatus necessary is of the simplest character: we require an adequate box of accurate trial lenses, a good trial frame, test types correctly illuminated, and a flat retinoscopy mirror. We must work in a room which is at least 20 feet across the diagonal, and we require a small but bright source of light.

Probably few today use the concave mirror; it has nothing to recommend it. In many mirrors the hole is too large; 3 mm. gives the best effect.

[The concave retinoscopic mirror is preferred by many examiners. It is interesting occasionally to use both, as a check measure. An important point that should be emphasized, is to be sure that the sight-hole has dull black edges. Bright edges are sure to cause annoying reflexes.—Ed.]

The source of illumination should be about the size of a shilling, and having cut down the size we must compensate by using a brilliant light. The room should not be completely dark; objects at the end should be visible, otherwise, working without a cycloplegic, it will be impossible to secure full relaxation of accommodation. The old-fashioned dark room is an anachronism; it is better to work in a room with curtains sufficiently thick to obscure but not entirely exclude the light.

[It is the general belief that accurate retinoscopic results cannot be obtained unless the accommodation is completely relaxed by a cycloplegic. The shadows are much more clearly defined if the room is absolutely dark.—Ed.]

The retinoscopist must learn to use both eyes with equal facility, otherwise when a cycloplegic is not employed he cannot refract near the macula, because his head will prevent the patient from fixing an object immediately behind him, and the retinoscopy will be inaccurate. It is essential that the surgeon have good personal acuity, that he may appreciate the tenuous central shadows which alone determine the point of reversal.

In difficult cases it is wise to use cylinders as well as spheres. When the astigmatism has been approximately determined place the appropriate cylinder in the trial frame and alter it till a sphere corrects both meridians simultaneously. This method is very sensitive and is especially valuable when working without a cycloplegic.

Errors in retinoscopy depend almost entirely upon failure to work near the macula. In many eyes the posterior pole is not truly spherical and slight eccentricity in the retinoscopy may introduce an error of a dioptre or more. Generally speaking, retinoscopy should be accurate to within a quarter of a dioptre, but there are cases with scissor shadows and other manifestations of irregular astigmatism in which the limit value is far higher. Corneal nebulae render retinoscopy difficult and often impossible. If a cycloplegic be used incomplete paralysis of accommodation is a fertile source of error, in fact it may be far greater than we are likely to get without the use of a drug.

In all cases, except infants who cannot read, the final adjustment will be made with the trial lenses and test types. Intelligent children over 5 years old will give valuable information during the subjective test, in fact they are often more helpful and sensible than some adults. There is a tendency to underrate the intelligence of the child.

When each eye has been examined separately it will often happen that together they will take a stronger convex lens, a fact that has been emphasized by Priestley Smith.

The Use of Cycloplegics. There is still a wide difference of opinion to what extent we should use cycloplegics in refraction. The author's practice is to use atropine for young children, but to refract the majority of patients without cycloplegia.

Cycloplegics are necessary in infants who have not sufficient concentration to fix a distant object, and in cases of spasm of accommodation. Hirschberg tells us that this is one of the rarest of ocular abnormalities, and most ophthalmologists will agree with him. We meet with the ready and powerful accommodation of the young and the irritable action of the ciliary muscle in neurotic persons. Such may not easily accept the full correction of their hypermetropia, but a properly conducted retinoscopy will rarely fail to show the full amount. If the patient will not accept the total correction of hypermetropia as shown by the shadow test, then it is wise to check the result with a cycloplegic. Generally the final result is the same.

Although it is permissible for the experienced to work largely without cycloplegics, the beginner will use them frequently; with increasing practice he will gain confidence and that instinct for spotting the "wrong 'un" which comes from constant association with patients, and he will use drugs less and less. Homatropine is not a reliable cycloplegic, and it frequently gives less hypermetropia than one gets without it.

In any case, assuming that an occasional error is made by working without a cycloplegic and that no errors accompany its use—a very large assumption—even then this infrequent lack of accuracy is preferred by the author than to submit a large number of patients to the discomforts of cycloplegia.

Myopia. Myopia is the most interesting and important error of refraction—interesting because of the uncertainty of its genesis, and important because it so frequently ends in grave loss of sight and even blindness.

There are two types of short-sight; one we may call overgrowth myopia, the other progressive myopia. The first is a development anomaly, the second a disease.

Emmetropia is the result of a correct balance between the strength of the dioptric system of the eye and its distance from the retina. The young eye is hypermetropic and attains its final refraction when its growth is complete. In most cases the eye finishes with a more or less correct balance between axial length and lens strength, but there are units above and below the base line. On the one side we have cases in which the eye is short in proportion to lens power (the hypermetropes), and on the other those eyes which are too long in proportion to dioptric strength (the myopes). These myopes are not diseased, and the error, which rarely exceeds 3 dioptres, does not as a rule alter.

Progressive myopia is entirely different; here we have an eye in which the posterior segment gradually elongates. In time, if the stretching passes a definite limit, the sclera expands faster than the inner tunics of the eye, and there is developed first a myopic crescent, and eventually a posterior staphyloma. At the same time low-grade inflammatory changes take place in the choroid, and the retina begins to suffer, more especially at the macula. Hæmorrhages may appear at the fovea and large areas of the retina and choroid disappear, leaving extensive white plaques of bare sclera at the posterior pole.

These destructive changes are accompanied by serious loss of acuity. In some cases the retina refuses to stretch any further and becomes detached. This tragedy is more frequent in cases which do not show the extensive destruction of the choroid, but it may take place in any case of progressive myopia even when of comparatively low degree.

Causes of Myopia. For many years there has been much discussion about the cause of myopia. A generation has passed since Cohn and his supporters coined the objectionable term "school myopia," and put forward the theory that advancing short-sight was due to the effect of close work. The upholders of this view showed that the degree and incidence of myopia increased in proportion to the age of the scholars, and that myopia was more common in those who used their eyes for near work than in others who led an open-air life. The first statement is true, and it is equally valid for the length of nose or leg of the same children. The second is but partially true. Statistics of thousands of cases of myopia are available, drawn from German, British, and other sources. They bring out the curious fact that examples of progressive myopia of the worst type with fundus degeneration are more common in agricultural than in urban districts. Moderate myopia is commonest in towns, advanced in the country.

The facts point to the real cause of myopia—heredity. Myopia is also a racial disease. It is said that it is commonest in the Roman Campagna, because for centuries this area has been the recruiting ground for the constant wars of the past; the myope was rejected for military service and lived to perpetuate his kind. Short-sight is notoriously prevalent in Germany—decimated by the Thirty Years' War—and among the Jews. Myopia is rare in Britain, a country that has been spared the annihilating wars of the Continent.

The objections to the theory that myopia is due to close work *per se* are conclusive. The suggestion is that during the act of accommodation and convergence the intraocular pressure rises and gradually distends the organ. It has not been proved that such a rise of tension actually takes place, and even if such were the case the conditions found in the myopic eye are not those which are present in an eye which has been subjected to real well defined high tension. In glaucoma the hypertony is associated with cupping of the optic disc, whereas in myopia the stretching is more evident further forward. It is by no means uncommon to find myopia in infants, who have not used the eyes for near work, and cases are common with high myopia in one eye alone. These facts are all against the theory that close work causes myopia. We must seek another cause, and we find it in heredity.

After an illness the myope needs a long rest, for it has been noted that an increase in myopia synchronizes with debilitating disease. The myope must be examined once a year and he must wear his full correction constantly. It was once the custom to order special reading glasses for myopia. It was supposed from anatomical considerations that the ciliary muscle was weak and accommodative power defective. In the majority of cases, and especially in the young, this is bad practice. The myope has ample accommodative power, and he becomes presbyopic at the same age and to the same degree as the emmetrope. If, however, an adult myope has never worn a correction, he has not trained his accommodation, and for a time he will find it difficult to read with full correction. If his myopia be under three dioptres the average man will wear his glasses for far sight only. No rules can be laid down for the correction of very high myopia, nor for the strongest lens that can be worn with comfort. The rule is to give our patients the best acuity possible with due regard to comfort.

Hypermetropia. A high degree of hypermetropia will call for constant correction, but it is unnecessary to order spectacles for moderate long-sight which is causing no symptoms. It all depends upon the individual; some must wear their glasses always, others for near work only, while a third category can read and sew comfortably without optical aid. The young eye has an immense reserve of accommodative power and can utilize it without detriment as long as the general health is good.

Astigmatism. The greatest care is necessary to obtain an accurate measure of the angle and degree of the astigmatism of an eye. Retinoscopy will give the approximate figure within about half a dioptre, especially if a cylinder is used for the final determination, but the ultimate choice depends upon the patient himself. Some of the astigmatic clocks are useful but a good set of test types with standard illumination is advised and the last adjustment is made with the aid of Jackson's crossed cylinders. A very few patients, and those mostly with an acuity of 6/3, are able to appreciate a difference of one-eighth dioptre, and they must be refracted within this limit, for they may be uncomfortable if the cylinder be not accurate to an eighth of a dioptre.

A full correction should be ordered for astigmatism except when it is extreme; in such a case it is wise to under-correct the astigmatism at first and proceed to the full correction when the patient has become accustomed to the first glasses. In any case we warn our patients with high astigmatism that they may at first suffer from some distortion when the error is corrected. Very high cylinders can be worn with comfort.

Presbyopia. The correction of presbyopia is not difficult if we use common sense; we must curb our desire for scientific accuracy, for few of our patients will appreciate the work of Donders. Generally speaking it is safest to undercorrect presbyopia. After 50 it is better not to add more than 2.5 dioptres to the distance correction. Even if the smallest print cannot be read and the work has to be held at a greater distance, the under-correction allows for work at a middle distance, and is more convenient for writing. In many cases we order three pairs of glasses—one for far, the second for near, and the third for music. A low myopia over 50 years of age will often be well suited with a pair of lenses one dioptre under the full correction. These will give him an acuity of about 6/12, which is ample for everyday requirements; they will afford full acuity for middle distance, and with them he can read large print.

Spectacles. It is important that the lenses shall be correctly placed before the eyes, for all the work of a careful surgeon may be stulified by a careless and ignorant optician. For most purposes spectacles are better than pince-nez, but there are types of pince-nez which are perfectly satisfactory. The form which has a horizontal split bar and a coiled spring must be avoided, for it does not maintain a fixed distance between the optical centres and soon loses its rigidity.

Meniscus lenses and torics are best avoided for the following reasons: the optical advantages are largely theoretical, they are fragile and expensive, and they are disfiguring. No woman should wear torics. A pair of flat lenses with a delicate central mount is almost invisible, and gives a glint of light in but few positions. The toric reflects light in every position and gives the wearer a glazed appearance, hiding the eyes. Except for special occupations there is little or no advantage in Crookes's glass, which is expensive and absorbs much useful light. The combination of toric lenses and Crookes's glass, is a fruitful source of financial loss to the poorer classes of society. In general the public will choose its own fitting, and we should avoid any interference with the individual preference, merely indicating what we consider to be best or essential.

Changes in Refraction. The refraction of an eye cannot be regarded as final and unchanging. During the growth of the eye, in adult life, and in old age, alterations occur—some regular and progressive, others irregular, and a few oscillatory in nature.

Errors of Muscle Balance. Heterophoria is theoretically a difficult subject, but fortunately for all practical purposes its detection, measurement, and correction can be carried out along simple lines.

If means are taken to abolish fusion the visual axes of the two eyes should remain approximately parallel. This state is called euphoria or orthophoria. If one axis rises or falls with reference to the other the condition is called hyperphoria or hypophoria. Diverging axes are named exophoria, and crossed axes esophoria. There is in heterophoria a tendency for the visual axes to depart from parallelism, and the necessary co-ordination is effected by excessive use of the fusion faculty. When the muscles are fatigued this state of suppressed squint may become actual strabismus, and diplopia may be complained of.

It is obvious that heterophoria disturbs the co-ordination between accommodation and convergence, and that increased nervous energy is used up in each act of combined vision. In consequence fatigue will develop and cause asthenopia and headache. It is therefore essential that the error be corrected. We use the Maddox rod and tangent scale for testing the muscle balance at infinity, and the Maddox wing test for measuring the error at reading distance.

Hyperphoria causes most trouble, but is not common. The most frequent defect is weakness of converging power, and this causes difficulty in reading and needlework. It is corrected by adding prisms base in to the near glasses, and such an addition is greatly appreciated by those who have convergence insufficiency.

[Probably no two men follow the same routine procedure in the examination of refraction. Some American ophthalmologists will doubtless disagree with some of the author's statements with regard to the employment of cyclopegics, and in the employment of toric lenses. Many patients suffering from photophobia are made perfectly comfortable with Crooke's lenses.—Ed.]

Control of Painful Accommodation. In this and other countries where the most prevalent refractive defects are hyperopia or hyperopic astigmatism, the services of the ophthalmologist are most frequently sought for the relief of discomfort or pain in or in the vicinity of the eyes or in some part of the head, this symptom usually being associated with smarting, blurring of print, and a whole galaxy of minor complaints which are grouped under the term "asthenopia." Since myopia and myopic astigmatism are relatively infrequent, as compared with refractive states in which axial shortening is the fundamental defect, it follows that the complaint is much more frequently "inability to use the eyes" than it is "inability to see." This discomfort is aggravated by the use of the eyes.

In the majority of such patients an accurate correction of the refraction (and by this is meant the determination of the refractive error to the eighth of a dioptre for the axial ametropia and the astigmatism, and the precise placing of the axis of the cylinder), associated with the correction of any vertical muscular error and appropriate management of lateral imbalance by means of prisms, exercises or operation, as may be indicated, will abolish all symptoms and permit the eyes to respond painlessly to all the demands of modern life.

It is a very common experience to find a patient suffering from a variety of asthenopic symptoms, including pain, whose distant vision is defective. The assumption that the refractive condition is one of myopia is strengthened by the improvement in vision, often to normal, by the placing of minus spheres (or minus spherocylinders) before the eyes. It is in cases of this type that the refracting optician frequently prescribes minus lenses, and is chagrined to find that his glasses, far from relieving his client, lead only to an aggravation of symptoms.

To the ophthalmologist, the true refractive condition is instantly revealed when the patient's eyes are put under the influence of atropin or some other reliable cycloplegic—a hyperopia, hyperopic astigmatism or rarely mixed astigmatism—which has been concealed by increased convexity of the lens dependent on exalted tone or "contracture" of the ciliary muscle. In many cases the prescription of proper lenses, but little weaker than the static measurement, leads to the happiest results. The "contracture" promptly yields to the combined effect of plus lenses and the complete physiologic rest of the ciliary muscle afforded by the cycloplegic.

Such a fortunate result, however, is not invariably attained. As soon as the ciliary muscle regains its activity after the effect of the "drops" has worn off, the contracture recurs, the eyes again become pseudomyopic, and the patient, while admitting that the glasses help for near work, bitterly complains that they make his distant vision very much worse. It requires great tact on the part of the examiner to gain the confidence and cooperation of the patient during the uncomfortable and trying period of adjustment to the new conditions imposed by the glasses. Before the spasm finally yields, it may be necessary to resort to several periods of atropin cycloplegia.

The task of the examiner is to determine how much of latent hyperopia is due to tonus and how much to contracture, and to prescribe a glass which shall do no more than "relieve the excessive action."

Accommodation associated with pain due to contracture of the ciliary muscle is characteristic of the extremely common types of cases just referred to. But there is another important, though not very large, group of cases in which accommodation provokes pain, often excruciating and utterly incapacitating, and in which there is no accommodative cramp.

The inadequacy of routine measures in the management of these cases is well recognized by those who have given the subject much thought. The possibility that a patient who complains of pain in using the eyes may be suffering from "painful accommodation" should always be borne in mind. Several follow-up visits after glasses have been prescribed may be needed to establish the diagnosis. Too frequently, we suspect, the diagnosis is missed altogether, and the patient, unrelieved, drifts from one adviser to another. Sooner or later he is labeled "neurotic" and is shunted off to a psychiatrist, whose failure to help results in the patient consulting a representative of one of the cults. It is always possible to abolish the pain in this condition by rendering the accommodative apparatus functionless by means of atropin, but it is obviously impossible to keep a patient permanently under the influence of atropin; and, moreover, in persons with presbyopia, such a procedure is not without danger of inducing a rise of tension in preglaucomatous eyes.

With these considerations in mind, it occurred to John Green and Greenfield Sluder[8] that it could be possible to control the ciliary pain by indirect measures. As pain is the sole disabling factor, if some means other than atropinization could be found of controlling this factor, there would be far less difficulty in reestablishing the normal function of the ciliary muscle. It was recalled that, in 1908, Ewing reported the complete relief of the pain of an acute glaucoma within a few minutes after the application of a 50 per cent. solution of cocain to the mucous membrane over the site of the nasal ganglion. If the pain of glaucoma and the pain incident to a congested or inflamed ciliary muscle (iritis) can be controlled by this measure, it seemed likely that it would be equally efficacious in functional hyperaesthesia of the ciliary muscle.

These authors report a number of cases in which the nasal ganglion was injected (.5 c. c. of 5 per cent. plenol, 95 per cent alcohol), followed by a marked cessation of painful symptoms.

Was injection of the ganglion a positive factor in the improvement of these patients? Would they not have improved as rapidly and as well by accurate correction of the refraction, atropin rest periods and systematic ocular exercise (reeducation of the irritable ciliary muscle)? Experience indicates that while these measures are necessary and essential in every case and may suffice in the milder examples of this trouble, they are likely to fall short of entire success: that while there is usually improvement there is only rarely a definite cure.

The one conspicious feature—pain—occurs whenever the ciliary muscle is called into use by the act of accommodation. Other symptoms of asthenopia, if present,

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(8) Jour. Amer. Med. Ass'n., Nov. 24, 1923.

are inconspicuous. The pain increases in intensity, the longer the patient uses his eyes, until at last it becomes unbearable and the patient has to desist. It does not terminate with the cessation of near work, but continues for many hours after the accommodation has been inactive.

Injection of the nasal ganglion, by eliminating the disabling symptom—pain—is a very real factor in permitting the patient to resume the normal use of his eyes. It is a truism that one shrinks from exercising any bodily function that experience has shown will surely give rise to discomfort, and this disinclination is not solely confined to highly sensitized persons—the so-called neurotics. If, after repeated trials, a patient, equipped with the most exact refractive correction, experiences pain after a few minutes use of the eyes and finds that his painless reading periods do not become longer, however assiduous his practice and however faithfully he may carry out his physician's orders, he will inevitably despair of ever fighting his way through.

On the other hand, if nasal ganglion injection, by abolishing his painful sensation, reveals to the patient a new power and a new endurance, the early reestablishment of the normal function of the ciliary muscle will not be difficult.

H. Byrd[9] reports a case in which there was a very great discrepancy between the cycloplegic—and post-cycloplegic examinations, and that this discrepancy was greatest in the left eye, the excess accommodation amounting to more than a diopter over the right eye. This fastened suspicion on the left side of the nose and a search was made for the trouble. In the post-ethmoid field a small but highly organized polypoid growth was found. Treatment was instituted and gradually the excess accommodation lessened. The two eyes were still

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(9) Eye, Ear, Nose, and Throat Monthly, May, 1924.

not quite together when the patient passed from observation, but there was marked improvement, not only in the eyes, but in the general symptoms.

A more striking case was that of a man in the early thirties—a newspaper man who used his eyes a great deal. In the examination for the cause of his asthenopic symptoms, refraction showed a small error totally inadequate to account for the symptoms. But the post-cycloplegic examination revealed excess accommodation in the right eye. This eye was the one that was giving him the most distress. A search was instituted for nasal trouble and a hyperplastic post-ethmoiditis was found. Glasses were not prescribed at all, but this trouble was placed on appropriate treatment, and in a few days his eye distress had entirely abated although he had kept them in constant use, sometimes as much as sixteen hours a day. Other less striking cases have been observed all in harmony with these findings. A good rule to follow is: Whenever there is a marked discrepancy between cyclóplegic and post-cycloplegic findings, the cause should be sought in Meckle's area.

THE EYELIDS.

Edema of the Eyelids. Although edema of the lids is a trivial incident in the course of many diseases, those extreme instances that attain disfiguring proportions with no obvious origin constitute a major problem in diagnosis. S. Judd Beach* presents the report of two such cases, curiously similar in appearance, but otherwise unrelated. Both showed trifling increase in temperature and malaise, with no local evidence of inflammation and no albuminuria. Yet they turned out to be diametrically opposite in origin. The first was a by-product of systemic infection; the second, a local disorder.

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*Jour. Amer. Med. Ass'n., July 5, 1924.

The first was that of a woman, aged 22, who complained of swelling in the lids and cheeks, which was of a few days' duration, was usually greater on the right side, and which subsided slightly during the day. There had been no pain or redness. The only subjective complaint was a slight stiffness of the face.

Inspection showed symmetrical swelling of the lower lids and cheeks, somewhat reminiscent of mumps. It was marked just below the zygoma, but on palpation appeared not to involve the parotid. There was no tenderness. The conjunctiva was normal, and the tear ducts patent to collyria. The teeth appeared sound. Examination of the urine disclosed no albumin, sugar or casts. The temperature was 99; the pulse, 92. Except for the story that the right side had usually been larger, there was no indication of local origin.

Rhinologic examination was negative.

Two days later she reported again with slightly less swelling but a little increase in fever; the temperature was 101; the pulse, 96. There were still absolutely no local symptoms aside from the swelling. Lassitude and the disproportionately low pulse were suggestive of typhoid. Blood was taken for Widal's test, and the patient was referred to her own physician for general physical examination.

Subsequent history showed the spleen a finger's breadth below the costal border, and the temperature 101 and pulse 100. The physician was not content with the negative report on the first Widal test and sent in a second specimen. Though it was again negative for typhoid, his suspicions were justified, as it this time agglutinated paratyphoid. That was the tenth day of the disease. At that time the edema of the face had entirely disappeared. There was no complaint of lassitude after the second visit to the infirmary, but, on the contrary, a sense of well being developing into excitement in the afternoon. No rose spots appeared nor abnormal urinary constituents. The disease cleared by lysis in about four weeks.

This relationship between the paratyphoid and the edema is apparently more than merely accidental. An identical attack of fever ushered in by swelling of the face was said to have occurred just previously in the same household. It is also recognized that typhoid fever, which in so many other respects is like paratyphoid, has the faculty, like glomerulonephritis, of increasing the permeability of blood vessels. It is possible that this episode explains those mysterious epidemics of edema of the face with typhoid symptoms and negative Widal reaction. Aside from the clinical value of this discovery its epidemiological importance is obvious.

The second case was that of a girl, aged 13, whose symptoms were not unlike those of the first patient. The swelling was symmetrical, was very evident in the lids and bridge of the nose, and was without redness, tenderness or other sign of inflammation. There was no pitting on pressure. It had been greater, but was said to be subsiding. The tear passages were patent to collyria, in spite of a slight swelling of the nasal mucosa. Some crusting showed at the vestibule of the nose. There was no chemosis or disturbance of the orbital structures. A Wassermann test and examination of the urine had been reported negative.

Recurrent attacks of this sort had extended over a period of seven or eight years, beginning in Italy during the World War, with so-called blood poisoning. The attacks had varied greatly in severity. They were sometimes accompanied by high fever and prostration, with the skin red and broken out with vesicles, and were more frequent in cold weather. During the recent intervals, the swelling never wholly subsided.

A laboratory examination revealed: hemoglobin, 70 per cent.; erythrocytes, 4,750,000; leukocytes, 12,000; the red corpuscles were a trfle pale; there were no parasites; polymorphonuclears, 63.6 per cent.; lymphocytes, 20.3 per cent.; transitionals, 15 per cent.; eosinophils, 1 per cent. Urine examination revealed a trace of albumin; no sugar, acetone or indican, and few hyaline casts.

The general examination at that time had shown an erysipelatous patch on the left cheek, and some exudate in the nasopharynx. The tonsils had been removed six weeks previously. The chest was clear. The glands, liver and spleen were not felt. The night temperature was 101.5 F.

The following year the patient went to the consultation clinic at the Massachusetts General Hospital. There the diagnosis lay between mucocele of the sphenoid, angioneurotic edema, and lacrimal disease. Rhinologic examination was negative. Roentgenograms of the sinuses revealed the right frontal sinus undeveloped; the frontals, ethmoids, and antrums clear.

Two years later the appearance remained the same. For four months there was at first some crusting around the vestibule of each nostril and along the lower portion of the septum on the left side, but not more than is ordinarily seen in this climate in perfectly normal persons. Under 1 per cent. mercurochrome ointment, crusts permanently disappeared from the right nostril and occasionally also from the left. In the meantime the patient's metabolism was estimated minus 9, which is within the normal limit. Thyroid produced no appreciable change in the swelling.

According to her story, she had been perfectly normal until one winter when one day a blizzard had suddenly developed. In spite of her protests, her teacher insisted that she go out with the other children at recess, with the result that the following morning she was in bed, with a temperature of 104. Two days later the temperature had dropped to 101. The right eye was closed by enormous swelling of both lids, and the left nasal passage was almost occluded by swelling of the middle turbinate, along the free border of which appeared a line of milky white pus. It will be noted that this was the naris opposite the affected lid. The right one, corresponding to the swollen lid, was absolutely free from swelling or crusting or other sign of inflammation. The left lids overlying the diseased side of the nose were correspondingly unaltered, except for one spot of discoloration, resembling a black and blue spot, about 5 mm. in diameter, at the middle of the lower margin of the orbit. The swelling on the right side was said to be subsiding and extending down toward the neck. A culture was made of the pus in the affected nostril for the purpose of making a vaccine. As with two previous cultures from the crusts in the same nostril, this yielded an unmixed growth of *Staphylococcus aureus.*

In this case, the roentgen-ray finding is strong evidence against sphenoidal or other bone disease. Orbital and conjuctival infections producing such marked swelling would cause chemosis. Absence of it and of eosinophilia was remarked in this case by Dr. George Derby in considering trichinosis. Blood parasites were not found.

The repeated inflammatory attacks would not occur in passive congestion. There is no localized point of sepsis in the skin, lids or ducts.

Arsphenamin had never been used, and there was no other reason to suspect arsenic or any of the unusual poisons, such as uranium, that produce edema. No acute infection accompanied by edema would last seven years.

The author describes the various varieties of edema of the eyelids that have been encountered, and goes into detail on the pathology, causation and diagnosis. A classification of many of the commoner types, modified after Fuchs, that has been so helpful in diagnosis, is given, with the hope that it will be useful in facilitating diagnosis of some obscure disturbances.

Opinion regarding the whole subject of edema and the interlocking field of immunity is in a state of flux, with new observations pouring in daily. This is not to be interpreted, therefore, as a definite classification, but rather as a basis for further modification. It is intended to include only those causes of edema which have been observed to affect the lids; but so easily swollen are these structures, owing, it is stated, to their lax tissues, that effusions of most diverse origin have been observed there. They often occur in the lids before appearing elsewhere, and it is common observation that occasionally this swelling is the sole evidence of disorders more or less grave. Not only for this reason, but also for the light that may be thrown on the fundamental yet complex and baffling subject of edema in general, these cases should be taken more seriously and reported more frequently, especially when the origin is obscure. Many of the most significant observations in these fields have been reported by ophthalmologists, and our opportunities are peculiarly extensive.

Sarcoma of the Eyelids. The subject of sarcoma of the eyelids is not such a rare condition that it needs exhaustive research, but the case that came under T. A. Fisher's[1] observation was very unusual, as all four lids were involved. There was also a metastasis beneath the angle of the jaw on the right side. The sarcoma had also gone down through the left antrum and through to the roof of the mouth on the left side.

The patient, Mrs. R., age seventy-seven, first noticed the growth six years ago, on the upper lid of the right eye, at which time she consulted an oculist. He told

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(1) Amer. Jour. Ophth., August, 1924.

her that it should not be removed or tampered with. From that time to the present she has seen various medical men, mostly general practitioners.

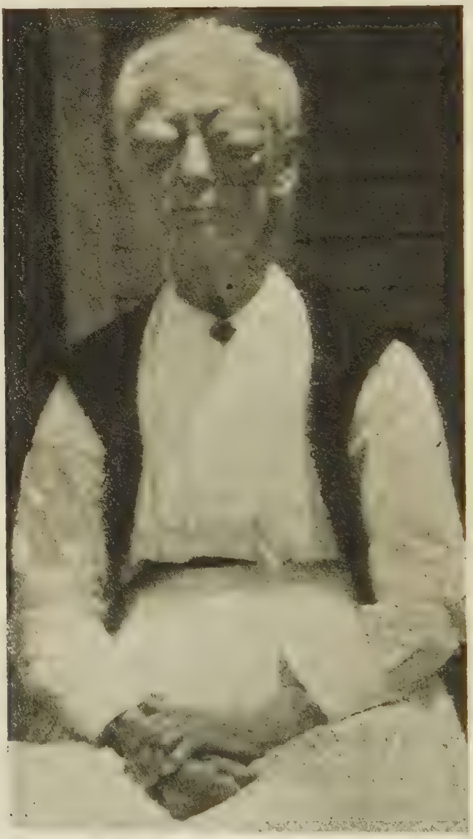

Fig. 1.—Spindle cell sarcoma of eyelid showing enormous swelling in both lids. Globes atrophied by pressure. (Fisher's case.)

The probable reason for the neglect of the case in the first instance was the fact that the right eye at that time was a cataractous eye. Three years following the development of the tumor in the right upper lid the left lids showed tumorous growths of the same character. The tumors on the left lids, however, have grown much more rapidly than those on the right and are now more than double the size of those on the right.

The intense pressure of the tumorous mass has practically caused atrophy of the eyeball so that now there is only a phthiscal globe in each orbit. In the case of the left side, ulceration has occurred with hemorrhages. A portion of the tissue from beneath the left upper lid was excised for microscopic examination, which showed spindle cell sarcoma. No effort was made to remove the tumor surgically as the involvement was so extensive that it would have probably been her death warrant.

Symblepharon Relieved by the Use of Wax Moulds and Thin Skin Grafts. All cases of symblepharon may be classified surgically into one or the other of two groups, depending on whether or not the exposed surface on the globe left after dividing the attachment can be covered with conjunctival flaps. Those cases in which a flap can be secured are more easily corrected than those in which this procedure is not possible.

One of the two cases reported by W. R. Parker[2] is described, in which the right lower lid was drawn up and attached to the sclera and cornea, the result of being struck in the eye by a piece of hot rivet. The inner half of the lower lid was attached to the sclera, inner third of the cornea and inner third of the upper lid margin. Nearly one-half of the palpebral fissure was obliterated. The upper lid was attached to the globe throughout its inner one-third. The eye was slightly convergent in the primary position. There was no movement of the globe on looking outward and only a slight movement on looking up or down. Vision, O. D. 6/30, O. S. 6/5.

The margin of the lower lid could be discerned running vertically from the middle of the lid as far upward

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(2) Jour. Mich. State Med. Ass'n., December, 1923.

as the corneal limbus at two. From this point it ran horizontally, joining the upper lid at the junction of the inner and middle third.

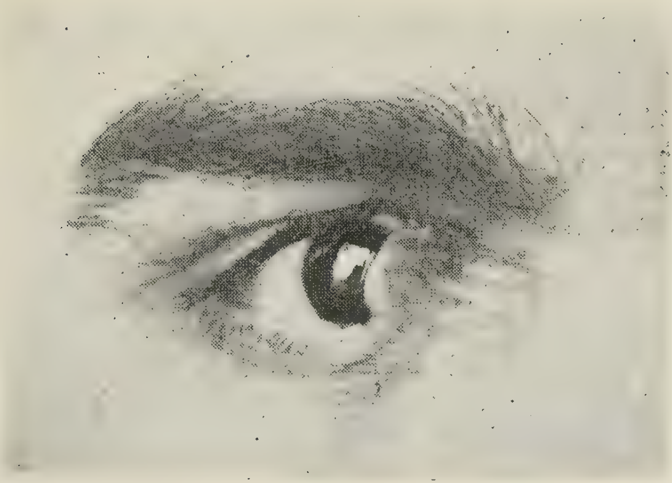
Operation—An incision was made along the course of the lower lid margin to the point of union to the upper lid. From that point it was continued just below the line of the upper lid margin well into the inner canthus. The mass was dissected from the cornea, sclera and tendon of the internal rectus muscle. After separating the lids from the globe, the scar tissue was carefully dissected out and the lids reduced in thickness to normal. The dissection was carried far back in the fornix both above and below. The lower lid fell back in place, although it seemed somewhat redundant at the time.

A wax mould was inserted over the globe. The mould, somewhat elliptical in shape with an opening over the cornea, was covered with a thin skin graft taken from the inner side of the right arm. The lids were sutured together and the ordinary dressing applied.

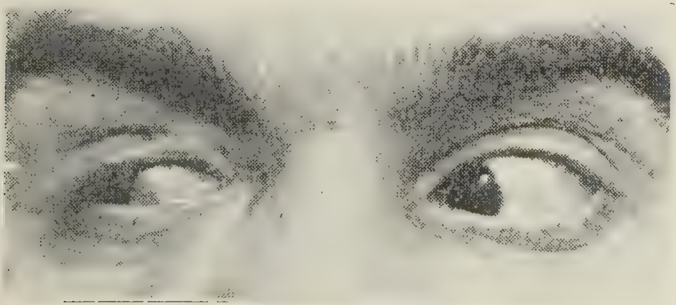
The eye was dressed on the eighth day, the wax mould was removed and not replaced. There was very little discharge and the graft had "taken" throughout the denuded area. The redundant portions of the graft were cut away and the eye left open. The treatment consisted of irrigation with boric solution and instillation of a 25 per cent. solution of argyrol three times daily.

At the time of the first dressing, the excursion of the eyeball was normal, the diplopia had disappeared, and the pulling sensation of the globe was relieved. The appearance of the eye continued to improve until it became quite normal, except for the opacity on the cornea, and a slight attachment near the upper caruncle (Plate III). There is no epiphera and the punctum in the lower lid was preserved. There was a discharge of degenerated epithelium for some time following the operation, but this was relieved by wiping the grafted area with a pledget of cotton saturated in alcohol. It is now four

PLATE III.

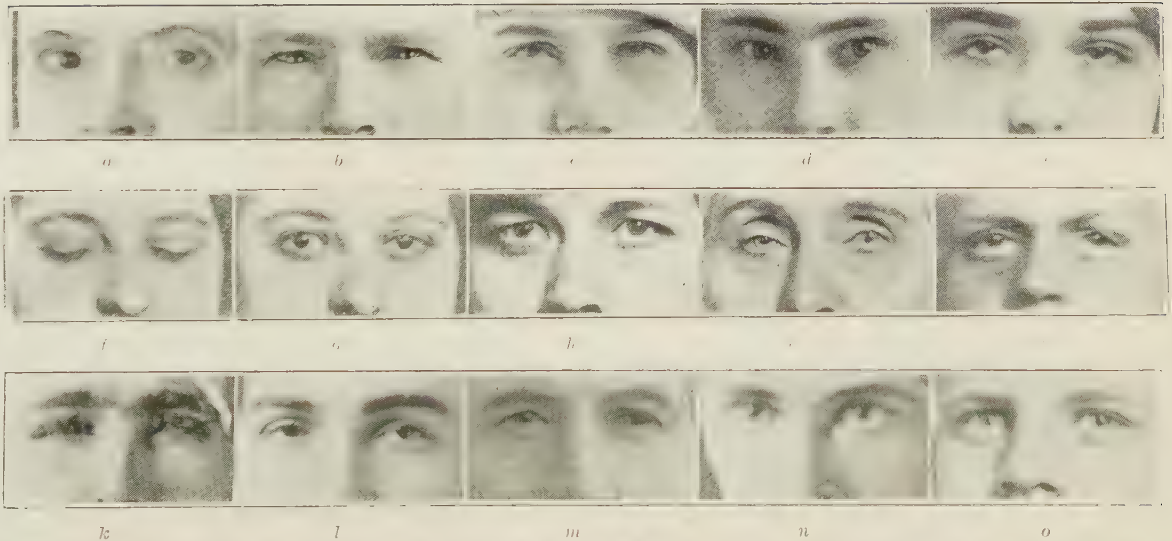


Symblepharon. Before operation.—Parker, page 71.



Photograph after operation showing position of lid and rotation of globe to right.—Parker, page 71.

PLATE IV



a—Vision (before operation)—O.D. light, O.S. fingers; (after operation)—20/30 both eyes. *b*—Vision (before operation)—O.D. 20/100, O.S. 20/200; (after operation)—O.D. 20/20, O.S. 20/60. *c*—Vision (before operation)—O.D. 20/100, O.S. 20/200; (after operation)—O.D. 20/70 both eyes. *d*—Vision (before operation)—O.D. 20/60, O.S. 20/40; (after operation)—O.D. 20/20, O.S. 20/15. *e*—Vision (before operation)—O.D. 20/100, O.S. 20/70; (after operation)—O.D. 20/20, O.S. 20/15. *f*—Showing lids closed, tenth day after combined excision. *g*—Same patient with eyes open. Vision (before operation)—20/40 both eyes; (after operation)—O.D. 20/20, O.S. 20/15. *h*—Vision (before operation)—O.D. 20/100, O.S. 20/200; (after operation)—O.D. 20/30, O.S. 20/20. *i*—Vision (before operation)—O.D. 20/200, O.S. 20/100; (after operation)—O.D. 20/40, O.S. 20/30. *j*—Vision (before operation)—O.D. 20/100, O.S. 20/70; (after operation)—O.D. 20/15, O.S. 20/20. *k*—Vision (before operation)—O.D. 20/100, O.S. 5/200; (after operation)—O.D. 20/40, O.S. 20/20. *l*—Vision (before operation)—O.D. 20/70; O.S. 20/60; (after operation)—20/15 both eyes. *m*—Vision (after operation)—O.D. 20/20, O.S. 20/15. *n*—Vision (before operation)—O.D. 20/100, O.S. 20/70; (after operation)—20/10 both eyes. *o*—Vision (before operation)—O.D. 20/60, O.S. 20/40; (after operation)—20/10 both eyes.—D. W. and P. C. White, page 73.

months since the time of the operation and there is no tendency for a return of the adhesion. The result is at least very promising.

The gratifying thing about the use of thin grafts in the correction of symblepharon is that if the scar tissue is all removed, and the denuded area completely covered, there is but slight tendency for the recurrence of the adhesions.

The use of vaselin in cutting the grafts as first advocated by the author in 1906, is still used in every instance when a thin graft is required and experience has proved its use greatly facilitates the ease of obtaining large and very thin sections of the skin.

Ossification in a Chalazion. In discussing the presence of bone about the eye we must consider two separate entities; namely, osteomas and ossification. Osteomas of the eyelids are exceedingly rare. W. S. Franklin and F. C. Cordes[3] were able to find but two cases reported of ossification of the lids. These observers report a condition that clinically had all the characteristics of a chalazion with a history of seventeen years' duration. The question of trachoma can be ruled out, as both conjunctivae were negative, no lines of atrophy being present. Microscopic examination showed true bone formation. An osteoma can be eliminated, the condition not being congenital but having developed following a "style." It can be reasonably assumed, then, that it was an old chalazion in which the granulation tissue during a period of years took on the properties of ossification.

Trachoma. After describing briefly the pathological changes which occur in the ocular tissues in this condition, D. W. and P. C. White[4] give a resumé of the results of their fifteen years of treating this disease. In addition to medical treatment, they have operated on more than

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(3) Jour. Amer. Med. Ass'n., Feb. 16, 1924.
(4) Texas State Jour. Med., May, 1924.

60,000 cases. The results of a few of the operative cases are shown in the accompanying illustrations. (Plate IV.)

The success of drug treatment alone, they state, depends on the strain of the virus present, and whether it is a true trachoma. Any astringent drug is harmful if it causes the formation of cicatricial tissue, and in their experience any astringent if used long enough will clear the cornea of the macroscopical and microscopical pannus, thus allowing the rough lid with its infective virus to rub the cornea, causing the formation of connective tissue in the place of the corneal basement membrane.

Silver nitrate has been the drug of their first choice, closely followed by copper sulphate and finally by bichloride of mercury. The other drugs, in the order used, are tannic acid, thiosinamine, boric acid and glycerin, dionin, methylene blue, iodoform, argyrol, acriflavine, ferric sulphate, optochin, jequirity, quinine and yellow oxide of mercury. Neither ion therapy of copper and iodine nor chaulmoogra oil and the analine dyes, ever proved efficient. Neo-silvol and lunosol have not been used long enough to report on their efficiency. Radium applications, in their limited experience, did not alleviate trachoma. Violet-ray therapy helped the pannus in a series of cases. In pannus, dionin and jequirty have proven efficient temporarily, but neither should be used for lengthy periods unless the lid condition is relieved. Stretching of the canthi aids pannus by relieving congestion and pressure on the cornea.

Systematic therapy is an aid to any form of treatment. Results with glandular extracts did not justify their use. Drug treatment must be carried on for at least two years in the very mild cases, and for a minimum of five years in the severe cases, with inspections and record of vision every four months.

Injections of milk in 86 cases, subcutaneously, stopped the iritic pains in many of them, but did not improve the trachomatous lid or eyeball· Subcutaneous injections of rheumatic phylacogen have practically stopped all iritic pain. Subconjunctival injections of cyanide of mercury in 52 cases, were discontinued, as there were no apparent good results. The same can be said of methylene blue, milk, quinine sulphate, magnesium sulphate, chaulmoogra oil, and argyrol. As yet, they are unable to report on bichloride of mercury, neo-silvol, lunosol, or on auto-blood vaccine used subconjunctivally. Diphtheria antitoxin in 286 cases did not prove of any value. and other vaccines have not been a success. The removal of spinal fluid in 10 cases (three times in one patient) gave slight improvement in vision for a few days only. Salvarsan (in 15 cases) and other intravenous drugs were not productive of results. Carbon dioxide snow in 282 cases lessened the hypertrophy for half an hour only, with no permanent good results.

The lesser surgical measures have been classified in accordance with their importance, as follows: (1) Sand-paper in all stages, least effective in the papillary type of young children; (2) grattage and bichloride rub in all stages, least effective in the hard-knobbed, cicatricial-island cases; (3) expression in all stages, least effective in the cartilage, with expression; (4) deep scarification of the conjunctiva and cartilage, with expression; (5) removal of the cartilage alone, and with the conjunctiva; (6) removal of the palpebral conjunctiva. Sand-paper causes less pain to the patient and less formation of cicatricial tissue than methods 2, 3 and 4. Vision held up for 18 years in sand-paper cases, on the average, and then finally began to fail.

Pannus dissection is advisable only in the cases where the basement membrane has not been invaded (289 cases). The dissection of the deeper pannus will result in destruction of the basement membrane, with the formation of smooth connective tissue. Perotomy, at its best, is an unwise surgical measure. It very often speeds up the formation of more extensive pannus (398 cases).

Peridectomy should not be performed, as the already shrunken ocular conjunctiva cannot afford to lose any of its tissue, and the pannus is very often increased 50 per cent (262 cases). Canthoplasty, stretching of the canthi and the correction of the entropion, will hold the pannus in check for the time being.

The purposes and indications for combined excision are as follows: (1) To remove pathologic tissue; that is, rid the lid of hypertrophy, thus preventing cicatricial tissue; (2) to cut short the long drug treatments, or the lesser surgical measures, and prevent sequelae, such as entropion, ectropion, pannus and the development of such complications as corneal ulcers and iritis; (3) to stop the development of different varieties of trachoma in one lid; (4) to reduce relapses and recurrent attacks to a minimum; (5) to prevent pannus and pannus sequelae, connective tissue formation and deep corneal ulcers, which cause loss of vision; (6) for entropion, ectropion, and other sequelae; (7) for cases where other methods failed; (8) in suspicious, undiagnosed cases, and in other cases where the patients will not carry out any form of treatment long enough, and where the doctor cannot follow up cases; (9) in cases with active, acute trachoma of the first degree, with granules and simple hypertrophy, especially in children; (10) in active trachoma, with formation of cicatricial tissue, or where such formation is inevitable; (11) in rough, hard-knobbed, cicatricial tissue cases, xerosis parenchymatosis, and simple and gelatinous tarsitis; (12) to do away with inflammatory complications and secretions and promote the disappearance of hypertrophy (Fuchs); (13) by rapid elimination of the disease, thus preventing its spread, especially in large families or institutions, during the course of long treatment; (14) to prevent loss of time from work for industrial workers and as legal protection for the industrial workers and liability compensation insurance carriers in cases of eye injuries complicated with old trachoma; and (15) in order to be able to correct refractive errors before the formation of connective tissue on the cornea and the destruction of Bowman's membrane.

The success of combined excisions is limited, due to non-preventable causes before operation, in the following types of cases:

(1) Old cicatricial palpebral trachoma, with connective tissue formation on the cornea; (2) old drug-treated cases of long duration; (3) corneal ulcers resulting from trachoma, or cases where cocaine has been used *ad libitum* on the cornea; (4) old deep nebulae of the cornea resulting from corneal ulcers, and (5) active corneal ulcers, with complicating iritis.

The proper form of treatment must be decided upon and then carried out by the surgeon. Combined excision will prevent and correct lid sequelae in unusual cases, and help the cornea in the great majority of cases.

THE CONJUNCTIVA.

Vernal Conjunctivitis. Vernal conjunctivitis manifests such a determined tendency to recur annually with the advent of warm weather, that one naturally questions: Is there no self-determination of this disease, no hope for its running itself out after a certain number of years, and if so, is there any fixed span of time in which this is accomplished? The observation of a considerable number of cases over a long period should be of assistance in answering such a query, and with this in mind W. C. Posey[5] made a review of all his private cases affected with this disease which had been under observation sufficiently long to be of value in such an investigation.

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(5) Atlantic Med. Jour., January, 1924.

This analysis revealed that in mild cases, those characterized clinically by the typical discoloration of the conjunctiva and the appearance of flattened granulations upon that membrane, with but slight or no bulbar involvement and with cessation of symptoms in cold weather, the disease often disappears after a period of from 8 to 10 years, very rarely in the four to six years mentioned by Saemisch in his classic article. In the severer types, those cases in which there is a persistence of the symptoms, though in less aggravated form through the winter months, with the presence of large hard and ofttimes rounded granulations studding the conjunctiva, with or without limbal involvement, it was ascertained that despite almost continuous alleviating treatment, the disease may continue for twenty years or even longer.

The author has observed one of his cases almost every year since 1899, a period of twenty-four years, another since 1902, a period of twenty-one years, another thirteen years, all occurring in healthy males. Another case, a female, with rather poor health, has been seen more or less frequently during the past 16 years. In all of these the disease appeared in early childhood and assumed the severe type. The first case presented the pericorneal involvement suggestive of phlyctenular disease which is so frequently observed in vernal conjunctivitis. In the two cases next alluded to, both corneæ had suffered epithelial denudation and some interstitial involvement when they were brought to the author, so that paring down of the large, round, hard granulations which had irritated the cornea and given rise to this condition was necessitated.

Though a cursory glance might pronounce the conjunctiva in these cases, after these years of inflammation, to be normal, a closer examination reveals a slight atrophy of that membrane, as indicated by an abnormal smoothness and the presence of a finely reticulated superficial membrane of blood-vessels. Furthermore, the advent of spring each year is usually attended by a slight renewal of subjective symptoms of irritation, such as lacrimation, itching, with at times a catarrhal discharge, provoked by a mild conjunctivitis.

Gonzales, writing from Mexico and quoting the observations of other colleagues from that country, without citing statistics regarding the frequency of vernal conjunctivitis in Mexico, gives the impression that this form of conjunctivitis occurs there much more commonly than is the case elsewhere. Juan Santos Fernandez, on the other hand, in the not far distant island of Cuba, where it is warm throughout all the year, states that out of a total of 61,000 eye cases observed by him, there were but six instances of vernal conjunctivitis, all of which came from Cuban cities. Feingold, in New Orleans, reports the disease of rare occurrence in that locality. In a characteristically able paper based upon the study of 44 cases observed over a period of 15 years and an experience gained by 10 years of earlier observation of scattered cases in Philadelphia, Jackson concluded that the disease is more common in the very elevated region of the western United States than elsewhere in our country.

In a summary of the experience with the disease of leading ophthalmologists from all parts of the United States, it was ascertained that though vernal conjunctivitis existed in all parts of our country, it was always rather a rare condition, occurring in a proportion ranging from one case of vernal conjunctivitis to every 200 to 500 of conjunctival disease. It would appear that the same frequency maintains in European countries. The apparent immunity of certain regions may doubtless be explained by its failure of recognition in such localities. Thus it is scarcely to be credited that, in 191,000 cases treated in Petrograd over a period of five years, there occurred but one case of vernal conjunctivitis.

Prognosis and Treatment. Now that radium is more generally available, the prognosis in vernal conjunctivitis may safely be asserted to be much more favorable and the likelihood of limiting the course of the disease greatly enhanced.

An extensive study of this condition leads J. F. Townsend[6] to the following conclusions:

1. Vernal conjunctivitis is an anaphylactic condition.

2. As vernal conjunctivitis has an antigen as its etiological factor, we may say that:

(a) The predisposing factor of vernal conjunctivitis and allied anaphylactic conditions is a cellular antibody of the precipitin nature, producing a sensitized patient.

(b) The exciting factor is some antigen.

(c) The protection is furnished through circulating antibodies produced by vaccines neutralizing in the blood the exciting factor.

(3) Since vernal conjunctivitis is an anaphylactic condition, cases of vernal conjunctivitis should be tested out with allergens, just as cases of asthma and hay fever are now tested.

(4). Treatment based upon these tests may be found even more effective than the vaccine treatment.

Parinaud's Conjunctivitis. Up to the present time, the etiology of Parinaud's conjunctivitis has not been definitely established. The following theory is in keeping with our present knowledge of anaphylaxis and protein sensitization:

A person who is sensitive to the protein of mountain cedar pollen, very quickly responds to a dose of it, whether administered locally on a mucous surface, or by vaccination, or by hypodermic injection of a weak solution under the skin.

The local response is characterized by swelling of an oedematous character if the application is made on a mucous surface; if by vaccination, or by hypodermic injection, within 30 seconds or one minute, there will appear at the site of the application, a typical wheal such as is often seen in nettle-rash. This will be followed by

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(6) Southern Med. Jour., July, 1923.

a red areola, extending to a radius of 2 inches or more, depending upon the size of the dose of the protein used, and will be accompanied by swelling of an oedematous character, the duration of which will vary with the dose, from 24 to 72 hours. Eleven hours after the local administration of a moderately large dose of cedar pollen protein, there will follow, in some subjects, constitutional evidence of the presence of the poison, in the shape of an attack of bronchial asthma.

These phenomena can be experimentally reproduced at any time, upon persons who are sensitive to this particular protein. It has been shown in recent years, that what is true of the cedar pollen protein, is true of a large number of other proteins, whether found in the food, in the pollen of plants or trees, or in the hair of animals or the feathers of birds. The resistance of different individuals to the effect of these proteins, varies widely, some possessing a very high resistance, others very low resistance. It has been observed that when resistance to the action of the protein is once overcome by an excessive dose, one is ever afterwards sensitive to that particular protein—in other words, he becomes sensitized. Whether he absorbs it through the intestinal tract or some mucous surface, the phenomena above described supervene. When the local effect reaches its maximum, it so impairs the resistive power of the adjacent tissues to infections of every sort that a local affection, due to some infection other than the proteins, may readily come into being.

In a case of Parinaud's conjunctivitis reported by H. L. Hilgartner[7], he suggests that the conjunctivitis had its origin in a local infection with the specific protein of the cow hair, and that the simple conjunctivitis thus produced, so lowered the defensive power of the conjunctiva and the tissues adjacent thereto, that the infection readily developed into an active state, and extended through the lymphatics to the glands of the neck.

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(7) Texas State Jour. Med., May, 1924.

The author reviews the literature of the cases of Parinaud's conjunctivitis that have been reported in the past fifteen years, with regard to its etiology. Some observers, including Rolandi, believe that Parinaud's conjunctivitis is not a distinct entity, but rather a clinical syndrome, and, in its classic form, a special type of tuberculosis of the conjunctiva, characterized by an exceptionally benign course and by spontaneous recovery. It has not yet been demonstrated whether this tuberculosis form is due to human or bovine tuberculosis.

On the other hand, Verhoeff describes a filamentous organism which he has found to be present in cases of Parinaud's conjunctivitis, and which he believes to be the cause of the disease. He has examined, histologically, 12 cases of Parinaud's conjunctivitis. All the cases presented characteristic histological lesions, and within areas of cell necrosis, characteristic micro-organisms were discovered. The micro-organisms were found in irregular masses, from 10 to 60 microns in diameter, and were composed of filaments. The individual filament is extremely delicate, stains faintly and has single contours. At intervals along the filament, round dots occur, which stain intensely by the modified Gram method. The filaments are usually about the thickness of the influenza bacillus. With the exception of one case, the micro-organisms were found only in, or within the close vicinity of well-marked areas of cell necrosis.

Verhoeff summarizes as follows:

"In eleven out of twelve consecutive cases, each having the clinical features described by Parinaud, and each presenting essentially the same characteristic picture, a minute filamentous micro-organism was found. The absence of any other demonstrable micro-organisms in the lesions, the unusual character of the micro-organisms found, their great abundance, and the fact that they were so situated as to explain the lesions, leave no reasonable doubt that they were the cause of the disease. Their occurrence in the areas of cell necrosis confirms the diagnostic importance of these areas.

"Since no branching of the filaments could be made out, the micro-organism may, for the present, be classed as a leptothrix.

So far as can be ascertained no similar micro-organism pathogenic for man, has previously been described. Now that its morphology in the tissues and suitable methods for staining it are known, its cultivation on artificial media should be accomplished. The experimental production of the disease should also be attempted, monkeys, preferably, being selected for the purpose.''

Treatment of Chemical Burns of the Eye. Injuries of the eye from chemicals may be grouped according to their intensity. The mild cases require little treatment, other than a soothing collyrium, while severe injuries, in which there is complete destruction of the conjunctiva, may require the grafting of mucous membrane to take the place of the destroyed conjunctiva. Denig advocates the removal of the burned conjunctiva immediately after the injury, replacing it by mucous membrane from the mouth. This is contrary to the views of Wilder and many others, who do not interfere until granulation is well under way. But in the cases most frequently seen there is not, primarily, a complete destruction of the conjunctiva, though if the mucous membrane is not protected from irritative secretions, and kept separated from the opposing mucous membrane, there will later be sloughing and formation of symblepharon. It is to this type of cases V. R. Hurst[8] offers a method of treatment which he has found to be efficacious.

Starr has devised an effective method for the prevention of adhesions between the lid and eyeball, after injury from chemical burns. His operation consists of dividing the affected lid from its margin to the deepest portion of the cul-de-sac. The incision is made vertically through the center of the lid and involves all structures, skin, muscle, tarsal plate and conjunctiva. The two halves of the lid are turned back and stitched one to the side of the nose, the other to the cheek, where they are held until covered by new mucous membrane; then the cut edges are ''freshened,'' and sutured back in place.

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(8) Texas State Jour. Med., May, 1924.

This seems to be a radical procedure and many patients will object to having the lids divided. By modifying this method, good results may be had without the incision being made through the lids, with the resulting scar formation. The lids are turned and two or three sutures are passed through the retrotarsal folds then carried to the forehead for the upper lid and to the cheek for the lower lid, where they are held by adhesive tape until the burned conjunctiva has healed. The exposed conjunctiva and cornea should be kept covered with a dressing of sterile petrolatum, and irrigated frequently with boric acid solution, care being exercised to prevent drying of the cornea. For a short time at night, the sutures may be released and the lids allowed to turn back in place, to let the patient rest from the frequent changing of dressings. The result, in most cases, will be the complete restoration of the fornix, and the unimpaired mobility of the eyeballs. By facilitating the dressing of the injured surfaces, and by keeping infectious discharges away from cornea, this treatment enhances the prospects of preserving the latter.

With the increased use of the automobile, battery explosions have become one of the common industrial accidents, hydogen gas being generated during the time the battery is on charge, increasing as the point of electrical saturation is approached. This gas, which is highly inflammable when mixed with air, accumulates in the dead space within the battery above the liquid, and may be ignited by an electric spark, a glowing cigarette or a welding torch. Mechanics in garages and battery stations, should be warned of this danger, and required to wear protective goggles, large enough to prevent any acid from reaching the eye. In every shop where batteries are repaired, there should be a large bottle of a sterile, saturated solution of sodium bicarbonate, and an eye cup. Immediately after an accident, the eye should be irrigated thoroughly with this solution, in order to neutralize any free acid that may be present; then the eye should be filled with sterile petrolatum, and the patient sent immediately to a physician.

Attention has been called to the greater prevalence of burns of the eye, on account of the increased use of chlorinated lime for household purposes. In such accidents, the particles of lime should be removed and the eye irrigated with a weak solution of vinegar.

THE CORNEA.

Bismuth in the Treatment of Interstitial Keratitis. G. Kleefeld[9] draws attention to the modern high standard by which complete recovery from interstitial keratitis is judged; improved illumination and the corneal microscope betraying permanent flaws which more primitive methods of examination fail to disclose. Even when vision has been restored to normal, Kleefeld has never failed to demonstrate with the corneal microscope persistence of white patches and corneal blood vessels formed during the acute stage of the disease. At least this was the case before he began giving injections of bismuth. In one of his cases, given bismuth, the patient came under treatment in the early stage of edema of the cornea. Vision was already reduced to finger-counting, although the duration of the disease was only three weeks. Injections of bismuth were given without any great hopes, but after eight days the edema of the cornea had largely disappeared, only two or three small vascular bundles having succeeded in penetrating the cornea. The treatment was continued and the edema disappeared so completely that when the patient was

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(9) Eye, Ear, Nose, and Throat Monthly, May, 1924.

examined three months later even the corneal microscope failed to show any lesion. It is probable that complete recovery can be effected by specific treatment only before or during the stage of edema; when this has passed off the patient's fate is settled for better or worse. In a second case, in which one eye after the other was involved, the injection of bismuth aborted the evolution of the keratitis in the second eye after several injections had saturated the body with bismuth. In a third case, in which sulpharsenol had been given for a long time without any relief, and there were signs of glaucoma on the left side, the injection of bismuth was followed by the complete disappearance of ocular congestion, a return of the intra-ocular pressure almost to normal, and by diminution of the corneal opacity.

Exophthalmic Goitre Resulting in Blindness from Corneal Ulcers. In reviewing the literature of the last twenty-five years on goitre, J. W. Hinton[1] finds very few references made by either surgeons or internists to corneal ulcers resulting in blindness, as a sequela of exophthalmos in cases of exophthalmic goitre. Most of the references are by the ophthalmologists. Few of the standard books on goitre make any mention of it. Bram refers to it in his book on "Exophthalmic Goitre and Its Non-surgical Treatment."

Corneal ulcers may develop very early in cases of exophthalmic goitre and are not necessarily confined to the long-standing ones. Knapp reports a case of loss of sight in left eye and partial vision in right within five months from onset of enlargement of eyes. Wood reports that dryness of the eyes is one of the commonest complaints made by patients with exophthalmic goitre. In severe cases of exophthalmic goitre one should bear corneal ulceration constantly in mind, as it may appear at any time and has no relation to the duration of the disease.

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(1) Ann. Surg., April, 1924.

Local therapy seems to have very little effect on the eye condition and the cases usually progress to complete or partial loss of vision. Irrigations, argyrol instillations, bandaging, tarsorrhaphy, and resection of the outer wall of the orbit have been tried with very little success.

General treatment has consisted in ligation of all thyroid arteries, cervical sympathectomy, *x*-ray, and administration of thyroid extract. Rogers ligated the left interior artery in Knapp's case, with very little result, and later ligated the remaining arteries. The patient lost sight in his left eye but had partial vision in the right—6-200. Cervical sympathectomy has been tried a number of times with practically no improvement of the eye conditions.

Partial thyroidectomy in cases of corneal ulceration would seem to be the logical procedure, as in all other forms, both local and general, apparently fail to arrest the progress. De Schweinitz states that partial thyroidectomy meets with great success in the relief of exopthalmos. The author reports a case where this procedure was resorted to, with excellent results.

THE IRIS.

The Etiology of Iritis. This is a continuation by E. E. Irons and E. V. L. Brown[2], of the study of iritis, of which a series of 100 cases was reported in 1916. The present report includes 100 cases which have been studied by the same methods as in the previous series. These included a careful history and physical examina-

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(2) Jour. Amer. Med. Ass'n., Nov. 24, 1923.

tion to determine the presence or absence of syphilis, tuberculosis, gonococcal infection, and infections of the teeth, tonsils, sinuses, prostate, pelvis, or other structures which might give rise to metastic lesions in joints or eyes. The possibility of invasion of the body by infection entering through mucous membranes without previous residence in a local lesion in the body was considered, and will be discussed below. Laboratory examinations included Wassermann tests, usually controlled by a second laboratory, complement fixation tests for gonococcal infection, roentgenograms of the teeth and sinuses, and of the lungs when there was any question of pulmonary disease. Blood counts and blood cultures, and subcutaneous tuberculin tests after previous determination of sensitiveness by cutaneous tests, were made in suitable cases.

Each patient presents a problem for solution, the ascertainable facts being the history, including the time relations of the onset and recurrence of iritis and infectious processes of the several kinds, the results of physical examination and laboratory study, and the results of treatment directed to the removal or cure of the infections discovered. It is a matter of general experience that the relations of cause and effect may be readily demonstrable in some cases, while in others, several possible causes are present and it may be impossible to state which infection was immediately responsible for the lesion in the eye. Except in the simplest cases, there is thus unavoidably introduced an element of judgment as to which of two or more infections was the cause of the iritis.

The patients in whom one infection seemed to be definitely related to the iritis, but in whom the presence of other infections was disclosed by routine examination, the latter infections appear under their appropriate headings—coincident infections. In two cases, a thorough examination failed to demonstrate any infectious process; it is entirely possible, however, that some local infection was missed, or infection may have entered through apparently intact mucous membranes.

Decoloration of the Iris. Prof. Richard Cords of Cologne[3] reports four cases of a peculiar form of decoloration of the iris, and discusses the origin of this alteration. Because of the infrequent occurrence of this interesting condition, all four of the cases are here described.

Case 1. Elizabeth Z., 46 years old, did not perceive that she could not see with her right eye until 10 days ago, when a friend of hers told her that the eye was red.

Right eye: Vivid ciliary congestion. Cornea hazy and stippled. There were many small precipitates upon the posterior surface of the cornea, aqueous humor hazy, anterior chamber of normal depth. Iris was of greenish color; the tissue showed no clear structure. Pupil was miotic and not round, numerous posterior synechiæ, lens clear, vitreous full of dust-like opacities; with the ophthalmoscope only red pupil reflex. No increase of tension was present. Only light and dark could be distinguished; good projection. Left eye: Entirely normal.

In short there was a grave iridocyclitis, probably of syphilitic origin. The Wassermann reaction was not tested, because it was not known at that time.

During the hospital treatment, with atropin and mercury, the eye became quiet, but the patient would not stay longer than a fortnight.

Four weeks later the cornea was still hazy, and the precipitates persisted. The aqueous humor was clear, the pupil wide, but of irregular shape, posterior synechiæ, vitreous clearer. The V.=10/200. Afterwards the inflammation increased again. The precipitates became so numerous that the iris and pupil were scarcely to be seen. The precipitates are of deep brown color. V. only 1/500.

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(3) Amer. Jour. Ophth., January, 1924.

The patient did not continue the treatment and was seen again only 10 months later. The picture had thoroughly altered. The ciliary congestion has disappeared. The surface of the cornea was clear. Tension was not increased. Upon the inferior part of Descemet's membrane very numerous precipitates were still to be seen; they were all of deep brown color. The larger part of the iris was of a deep brown color and showed no signs of past iritis, except some posterior synechiæ. A large sector of the upper nasal part had lost all the pigment. While in the normal part of the iris the thick pigment layer makes it impossible to see the trabecules, they are very distinctly to be seen in the described sector. They formed a very clear network of pure white lines, between which small brown spots are disseminated; vessels were not to be seen in them. The discolored sector was sharply outlined against its surroundings. In its vicinity the iris showed a very dark discoloration. The pupil is not round. In the decolored sector the iris is broader; the pupillary margin is almost straight like a tendon. On account of the posterior synechiæ there is no movement of the pupil.

This decoloration concerns not only the anterior layer of the iris, but also the posterior. Everywhere the red light is seen thru the sector.

Case 2. Barbara S., 63 years old. Patient wore spectacles all her life. She had a binocular iridocyclitis 12 years ago with glaucoma following. Iridectomy was performed on both eyes. Since that time she could neither read nor write. Vision became gradually worse.

January 12, 1920. *Right eye*: No congestion, cornea clear. At the upper limbus a small scar of 5 mm. length, from which a grey tongue-shaped spot extends to center of the cornea. Anterior chamber is shallow. There is a circular posterior synechiæ, and a small coloboma upwards. In its marginal parts the iris has a deep brown color; the surface looks like velvet and the trabecules are not to be seen. The whole inner part of the iris in a breadth of 2-3 mm. has lost almost all the pigment. Only in the midst of the inferior part does the pigment reach the pupillary margin. In this altered area, the trabecules are quite clearly visible in the form of white stripes. Only with the corneal miscroscope and the slit lamp a few pigment cells are to be seen, scattered in the tissue. The sphincter muscle is visible as a small yellowish ribbon, but there is no contraction of it on account of the synechiæ. The pigment layer of the iris is evidently normal, because no red reflex passes the altered part of the membrane. Rather dense nuclear cataract; no details of the fundus can be seen. V.=Movement of the hand in all parts of the visual field. Tension normal.

Left eye: No congestion. Small scar in the inferior limbus. Epithelium of the cornea is not quite smooth, but a little stippled, especially in the inferior part. The examination with the microscope and the slit lamp shows different folds of the Descemet membrane. Anterior chamber is shallow. The iris shows nearly the same alterations as in the right eye, and a small inferior coloboma. Only the peripheral parts of the iris are deeply stained. Near the pupillary margin, in a breadth of 3 mm., the whole pigment is lost and only some brown spots are scattered in the tissue. A deep brown nuclear cataract is noted. V.: Fingers are counted at 0.5 m. Good projection of light. Normal tension.

On the next day the extraction of the right lens was made without complication, and afterwards the needling of the secondary cataract. No improvement of vision occurred because the cornea remained hazy and the vitreous was full of dust-like opacities.

In this case is seen the consequences of a severe iridocyclitis with posterior synechiæ, seclusio pupillæ and subsequent glaucoma, nuclear cataract and opacities of the vitreous. Instead of an atrophy of the whole iris with narrowing of the trabecules and the well known greyish-blue color, we perceive only a complete loss of pigment in the superficial layer near the pupil. The

Wassermann reaction being negative, we must assume that the disease had probably a tuberculosis etiology.

Case 3. Johann K., 50 years old, got a slight contusion of his right eye on January 26, 1922. Some days afterwards, there were all the signs of an acute glaucoma after using atropin. The cornea was stippled, the anterior chamber shallow, the pupil wide, the tension 60 mm. Hg. (Schioetz.) There was only perception of light. The iris had a greyish-blue color and seemed to be a little atrophic.

An iridectomy was performed, after which a small hemorrhage in the anterior chamber persisted for some days. The tension was normal at first, and vision became 1/12. A fortnight later, however, the tension increased again, the anterior chamber being extremely shallow.

April 26, a cyclodialysis was made, after which the tension was normal again. The effect lasting only 10 days. A trephining was finally made, after which the tension remained normal until now,— that is, for one year. During that time the iris lost the greater part of its pigment.

Present state: The eye is pale, the pupil larger than normal. There is a broad coloboma upwards. The cornea is clear. Peripheral parts of the iris are of a blue color. Near the pupillary margin, in a breadth of 2-3 mm., almost all the pigment is lost and the trabecules are to be seen as white ribbons. There is some atrophy of the whole tissue. With the corneal microscope many small brown spots are to be seen on the iris and on the lenticular capsule. The lens and vitreous are clear, and there is a glaucomatous excavation of the disc. V. with +3. S.⌒Cyl.+0.75 ax. 45° = 5/15. Visual field only 20-30° from the fixation point.

Case 4. Caroline K., 15 years old. Patient was shot with a pop-gun, 8 months ago. She immediately went to an oculist, who found the left eye very much congested. In the inferior temporal part of the cornea there was a large erosion, in the midst of which was a wound of 1 mm. length which penetrated into the external layer of the cornea. Some foreign bodies were removed. The wound certainly did not penetrate into the anterior chamber. Iris and lens showed no alteration. The eye became pale and painless within two or three weeks.

Present state: Cornea clear except a small macula in the midst of the medial half, no congestion. The pupil is distinctly larger than in the right eye. The light reaction is prompt in the superior part, but very slight in the inferior. No posterior synechiæ are seen, the lens and vitreous appear clear, V.=6/6.

The examination with the Zeiss microscope shows a very peculiar picture. While the right iris is of a dark brown color, with a velvet-like surface, we see this coloring in the left one only in the superior half. In the inferior the pigment of the superficial layer has almost completely disappeared and the trabecules, which cannot be seen in the normal part, are visible as a network of small white ribbons, with a tree-like ramification. The iris gets by this alteration in lamp light a white, and in daylight a bluish-white color.

The tissue is not atrophic; in the altered part the tissue does not seem to be thinner and less prominent. There is only an almost complete loss of the pigment. But this has not quite disappeared; with the greater enlargement we see the whole superficies as powdered over with small, round, brown spots, which lie partially isolated, partially in small lumps. The whole looks like thick milk, strewn with cinnamon. At the pupillary margin the brown spots lie more densely and are more numerous; in some parts they form accumulations like the eggs of a spider. The sphincter muscle is not visible. The border of the discolored area is not so sharp as in the other cases. Especially in the upper part the normal part goes quite gradually over into the decolored area.

This case is very peculiar, because there was no inflammation of the iris and no glaucoma, but only a contusion of the eye and a quite superficial lesion of the cornea.

The patient observed that the color of the eye changed gradually after the trauma, and the eye surgeon who saw her at first did not perceive any difference between the colors of the two irides.

In all these cases circumscribed parts of the superficial layer of the iris are completely decolored. There is no atrophy, because the trabecules have a normal form and size. An atrophy looks quite different; there is no white, but a greyish-blue color and the trabecules are small and straight. The whole tissue looks like grey blotting paper (Fuchs). Sometimes, as in the third case, a combination of atrophy and decoloration appears on the same eye, especially in glaucoma.

The four cases demonstrate that this form of decoloration may be caused by quite different conditions; iridocyclitis, glaucoma and contusion of the eyeball.

In glaucoma decoloration is best known. We find in the German literature some papers about the scattering of pigment (Pigmentzerstreuung) in glaucoma. At first Levinsohn found, in his pathologic examinations of glaucoma simplex, that in these cases numerous small pigment cells lie between the ligamentum pectinatum in the Fontana's spaces. These findings, which were confirmed by Roenne, Thomsen and Haussen, induced Levinsohn to propose a new theory of glaucoma, called the "pigment theory."

In 1916 Koeppe found with the slit lamp, that dark brown pigment spots lie dust like between the whole superficial tissue of the iris. They may be so fine and thin that they look like ground pepper; sometimes they are collected into small crumbs. The color of the spots being very dark, Koeppe thinks that they are derived from the pigment layer. Indeed, in many cases, in which the pigment lies especially near the pupillary margin, the pigment cells of the posterior layer are often corroded and destroyed. He thinks that it is possible to diagnose from this scattering of pigment a preliminary state of glaucoma, the "Præglaukom," as he calls it; a supposition which, however, was not accepted by most of the authorities on glaucoma. The fourth case, too, speaks against the theory of Koeppe. There is such an extensive scattering of pigment on the iris that it must be curious that no signs of glaucoma were to be seen.

About the "Pigmentzerstreuung" Augstein, too, wrote a very interesting paper. He showed that after an operation for cataract or glaucoma the scattering of pigment is quite typical. In these cases the whole inferior part of the iris is covered with small brown spots, looking like cinnamon or snuff. Also, after an iritis this scattering of pigment is not rare, as Vossius showed it; it is visible especially in those cases, in which an iridectomy has been made. Vossius describes the case of a man of 29 years, who had an interstitial keratitis with iritis, after which the whole iris was sown over with pigment spots. He supposes, that in these cases the pigment is derived from the posterior layer of the iris, from which sometimes large masses of pigment are detached. Scarifications of the pigment cells in this layer are also described by Axenfeld in old people. This author thinks that there is some connection with the etiology of cataract.

Soewarno, too, discusses this question. He finds in glaucoma a nacre-grey decoloration of the pupillary margin, beginning mostly on both borders of the coloboma. The decolored parts are distinctly bordered are seldom broader than a few millimeters, and sown all over with many pigment spots. The normal relief of the iris has disappeared. Soewarno thinks, that the decoloration is the consequence of noxious influences, working on the iris, its vessels and nerves, during the glaucomatous attack. Soewarno found a peculiar form of decoloration in syphlitic patients, where white spots are to be seen in the ciliary part of the iris. Koeppe says, that in cases of absolute or progressive glaucoma with a dark brown iris, a dissolving of the superficial pigment is not very rare, and that this change is often to be seen in a circumscribed or sector-like part of the membrane. The light brown pigment is in these parts completely rarefied; in some parts it has disappeared, in others it lies together in the form of small clumps. Koeppe supposes that in these cases probably a simple dissolution of the cells takes place, and that rests of the pigment remain in the form of small insulas. Finally, Levinsohn observed a peculiar decoloration of the iris in a woman of 61 years after one severe attack of glaucoma. Moreover, he found in a man of 54, after an attack of glaucoma, a light grey iris in this eye, while the other was light brown.

The author finds the greatest difficulties in explaining case 4. In the early period after the heavy contusion, there was no alteration of the iris to be seen; the decoloration appeared gradually some weeks later. We have no reason to assume an interruption of the circulation, but may think of a nervous origin. We remember the alteration in many cases of paresis of the sympathetic, where we see a loss of pigment too, even though not a complete one. Perhaps there was a combination of a transitory paresis of the sympathetic nerve fibres and a cramp in the vaso constrictors of the iris.

THE RETINA.

The Etiology of Retinitis Proliferans. By the term "retinitis proliferans" we designate that condition where fibroid changes have taken place in the retina, accompanied by vasculitis, so that dense masses of connective tissue extend out from the retina into the vitreous, often covering a portion of the fundus, and at times even the papilla itself. These masses are traversed by blood vessels which have been newly formed in the retina. The ophthalmoscopic picture given by different observers is fairly constant, though varying slightly in detail.

The exact etiology of proliferating retinitis is uncertain, but as pointed out by B. J. Larkin[4] the condition is dependent upon preceding retinal or vitreous hemorrhage is now well established. Recurrent retinal hemorrhages have been quite widely discussed in recent ophthalmic literature, but opinions as to the cause producing them are still at variance.

The progress of the pathologic process which results in the formation of the fibrinous masses characteristic of retinitis proliferans is outlined by Collins and Mayou as follows: If the coagulation time of the blood is high, coagulation will occur more rapidly than usual, while absorption will take place slowly. When the corpuscles have discharged their hemoglobin the stroma is broken up and the result is the formation of cholesterin. The fibrin being either absorbed or organized, the endothelial cells from the blood vessels spread out into the vitreous, and the formation of bands of connective tissue then ensues with detachment of the retina as a not infrequent sequel. When proliferating retinitis is due to trauma, war wounds, such as concussion of the globe, or penetration by a foreign body, offer frequent examples—there is often a resultant cicatricial process which pins down the retina by opaque, plastic-looking material instead of the detachment, which is more common in civilian practice, where proliferation is the result of extravasted blood.

Researches which have tended to demonstrate the tuberculous nature of certain types of endophlebitis have led ophthalmologists generally to assign infection by the tubercle bacillus as the causative factor in recurrent retinal hemorrhage. Zentmayer, writing in 1918, says

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(4) Jour. Ind. State Med. Ass'n., January, 1924.

that it is probable that there are several causes for these hemorrhages: tuberculosis, syphilis, gout, diabetes, or endotoxins, and that less constant factors are abnormal blood pressure and alterations in the composition of the blood, so that its coagulation time is affected. Manz believed that the cause of spontaneous hemorrhage resulting in the production of proliferating retinitis to be due to tuberculosis, syphilis, nephritis, or similar constitutional diathesis. Weeks was of the opinion that the essential etiologic factor in the production of retinitis proliferans is the production of membranes extending into the vitreous, and that the formation of such membranes must be preceded by fibrinous exudation or hemorrhage. Dupuy thought that the ophthalmoscopic picture seen in his case might possibly be due to the presence of "a remnant of the hyaloid artery," though the width of the area of fundus change after it approached the temporal half of the retina was a little broader than he thought consistent with the remains of the hyaloid artery; neither was the structure so fibrous and organized as one would expect to find the artery.

According to de Schweintz, "Syphilis is undoubtedly a cause in certain cases," and he also connects the development of proliferating retinitis with tuberculosis of the retina. He notes likewise that, "It has been ascribed" to anemia, chlorosis, arteriosclerosis, menstrual disturbances and the hemorrhages which they cause. Zentmayer, in a more recent paper than the one referred to tells us that the view concerning the etiology which seems now to be meeting with most favor is that the disease is an autotoxic one, the source of the toxemia, being in most cases the intestines. As a result of this toxemia, inequalities of the circulation occur, so that we have either too high or too low a blood pressure. Collins believes that the coagulability of the blood is raised and that this leads to the formation of thrombi in the venules which rupture as the result of the *vis a tergo*. Nieden is of the opinion that the cause of the hemorrhages is slow development of the sexual apparatus, which in the case of those most subject to the condition—young men near adolescence in almost all cases—is unrelieved, as in females by menstruation. Zentmayer's own theory—advanced, however, as but a ''thought'' in his mind—is that disturbed secretion of some of the ductless glands may be an important etiologic factor. As a very definite picture of tuberculosis of the retina is often lacking, and the age or sex are fairly constant (that is, adolescence in the cases occurring in males), and the general condition of the patients is strikingly similar—lassitude, low spirits, general asthenia, and a tendency to abnormal size being practically always noted—he regards as reasonably conclusive evidence that an endocrine disturbance is the casual factor. ''As the activities of the endocrine organs are interlocking, it would be impossible, probably, to indicate definitely the one at fault, although the symptoms point to the adrenals as the primary one.'' It is also significant that the administration of thyroid has in many cases resulted in marked benefit.

This view of the endocrine imbalance as a causative factor is also put forward by a Belgian writer, Van Duyse, who reported a case of recurrent retinal hemorrhages with periarteritis, polar cataract, and apparent neuro-retinitis, which he regarded as due to a ''pathologic state of the internal secreting glands.'' Tuberculosis and syphilis had both been excluded in this instance.

Tuberculosis, however, remains the most probable causative factor in the great majority of cases, and in those few where treatment has apparently been of some benefit the therapy has followed the lines laid down for the care of other forms of tuberculous infection.

Effect of Insulin in Treatment of Diabetic Lipemia with Lipemia Retinalis. Lipemia is characterized by an accumulation of fat in the blood. A moderate alimentary lipemia occurs after the ingestion of food, and only when it persists in spite of fasting is the condition to be considered pathologic. Patients with diabetes are predisposed to lipemia; and, even though the blood plasma may not appear milky, the lipoids are generally abnormally high, especially in the severe cases.

The treatment of lipemia has always been slow in yielding results. All workers agree that severe lipemia disappears slowly under dietary treatment. Thus, Geyelin reported a case in which the plasma had the consistency of thick cream, and which required two months' treatment that the plasma might be cleared of visible fat. The extraordinary results that have followed the use of insulin in the treatment of diabetes suggest that possibly this substance may also be effective in reducing the blood lipoids of diabetic patients to the normal value. Gray treated two cases of lipemia retinalis with insulin, and reports that the lipemia disappeared within a month's time. McCann reports a case of lipemia retinalis which was also treated with insulin.

In a case reported by A. H. Rowe[5], a girl of 15 had developed diabetes rather suddenly, about two months previously. For many days she had been unable to read because of blurred and hazy vision and menstruation had been absent for two months. There had been no diabetes in the family. At the time of diagnosis she had not been dieted except in a slight way for the previous three days. The patient was weak, exhausted and drowsy. Her skin and hair were very dry. Ophthalmoscopic examination revealed a startling picture. Across the retina in all directions were seen creamy bands instead of the usual blood vessels, and the retina appeared grayish instead of red, as in the normal. The blood drawn for the estimation of blood sugar and carbon dioxid was a light brown fluid, and on separation of the plasma a thick, gelatinous, creamy plasma was obtained. One wonders how this fatty fluid could circulate through the fine capillaries. The interference of vision was due to the lipemia retinalis.

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(5) Jour. Amer. Med. Ass'n., Apr. 12, 1924.

With proper diet and a large insulin dosage, she rapidly improved. Within four days she was able to read a little and her strength began to return. The presence of a severe state of acidosis, which was evident clinically, was confirmed by the low carbon dioxid value of 27 per cent by volume and the two plus diacetic reaction. There was rapid control of urinary sugar and of blood sugar by diet and insulin treatment. The control of acidosis is shown by the rapid return to normal of the carbon dioxid value and the gradual disappearance of the diacetic acid reaction as well as the excessive urinary ammonia. In order to control the lipemia, no fat was included in the diet during the first four days of treatment, and subsequently only small quantities of fat were added to the diet, while relatively large amounts of carbohydrate were prescribed, together with a sufficient dosage of insulin to bring the blood sugar to a normal value. However, at the end of four weeks' treatment the plasma was still milky, while at the end of two months though the plasma was clear, the fatty acid and cholesterol values were still above normal. Thus, even with a low fat diet and continuous sugar freedom, which was maintained by the use of insulin, the reduction of the lipemia was a slow process.

A case of lipemia retinalis is reported by Mark Gardner[6]. The color of the retinæ was salmon-pink. There was a general translucent appearance. The optic discs were waxy in appearance. The retinal arteries for some distance from the optic discs looked as if they contained milk instead of blood. A few of the smaller vessels near the periphery looked like white threads. The arteries, however, were easily distinguishable from the veins and were not flattened and ribbon-like, as has been noted in several of the cases reported. The choriodal vessels were normal in appearance; they evidently never show any change in this condition. There were no

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(6) Med. Jour. Australia, July 5, 1924.

hemorrhages or exudates. Vision was not affected. The rare condition of *xanthoma diabeticorum* was present on one arm.

The total ether soluble substances in the blood was found to be 12 per cent and the blood cholesterol 0.8 per cent.

During treatment for three months with thirty units of insulin daily and a diet of 1,600 calories, the weight returned to normal; the urine became sugar-free, and on fasting the blood sugar was reduced to 0.112 per cent. The blood fat did not in this time quite return to normal limits. During the most of his stay in hospital it was about 2 per cent. The lipemic appearance on the retinæ quite cleared a fortnight after insulin treatment had been started.

The earliest accounts of condition of blood to which the term lipemia is applied are by Rollo in 1798 and by Mariet, of Edinburgh, in 1799. The ophthalmoscopic picture which is associated, was first seen and described by Heyl, of Philadelphia, in 1880. Apart from a blood examination there is no other means of diagnosing lipemia than by ophthalmoscopic examination. Since the original case there have been twenty-nine cases described in the literature.

THE LENS

The Lens as Seen with the Gullstrand Slit Lamp and Corneal Microscope. The manipulation and understanding of the findings revealed by this instrument are difficult for the novice, and, as has been remarked, it means that a certain few among us will become specialists among specialists. Arthur J. Bedell[7], who made such

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(7) Jour. Amer. Med. Ass'n., Feb. 2, 1924.

an interesting contribution last year to our knowledge of the iris as shown by the slit lamp, makes a noteworthy addition at this time in his depiction of the lens structure by the aid of this instrument. The normal and pathologic changes in capsule and cortex, heretofore difficult of examination, are now more easily interpreted.

The Capsule. The anterior capsule consists of irregular quadrate cells which look like a tile mosiac; the surface may be smooth but is most often rough, giving the impression we get from cocain dryness of the cornea. At other times, many reflections from its surface recall craters on the moon. On the capsule may be found pigment deposits; star cells, rounded masses or lines. Remnants of the pupillary membrane may show as a distinct grayish-white accretion from which fibers pass to the iris, or as broad, white bands which come from behind the iris and often carry rounded pigment plaques. The capsule may become markedly thickened, showing even on gross examination as a white area behind the pupil. To this, fibers of the pupillary membrane may be attached, or it may be without such bands but with the faintest trace of pigment on its anterior surface. (Plate V.)

The posterior capsule cells are the same as those of the anterior, but by transmitted light usually show as an oval with brownish color and rough surface. Opacities in this capsule seem to be most often in a zone to be nasal side of the center; but they may be below and even to the temporal side of the apex. In size, they vary much, some being mere dots, even with the lamp, while others push the lens cortex forward and measure more than a millimeter. The backward extensions from these opacities may be short or long, single or multiple and with or without branches. These prolongations may be directly united with the vitreous, becoming inseparably associated with its structure.

Inflammatory deposits of iris pigment range from a single, minute area to an almost complete brown sheet.

Following inflammation, the capsule itself becomes thickened, and gray in appearance, and not uncommonly the underlying cortex is similarly involved. Clinically, this has been observed; but this method of examination enables us to see more distinctly the detail of the tension-reducing operation. The glaucomatous eye often gives the same picture of capsular pigment and subcapsular opacities.

The anterior and posterior capsules are studied after opening by operation or injury more completely than otherwise. Ordinarily the anterior capsule furls back after section, leaving a visible gray sheet. Cortical débris may be entangled, producing disorganized, gray masses, frequently with pigment specks on and in them. The globules and fibers such as seen in mature cataract may be so dominant as to give the appearance of an oily, refracting surface. Even in the most successful cataract extractions whitish gray folds with clear openings between them are often observed. The anterior vitreous may show the same gray lines, which may be misinterpreted as capsule unless due care is taken to differentiate. New blood vessels may extend over the anterior capsule as in old iritis. Both the anterior and the posterior capsule may be vascularized in deep intraocular changes, such as glioma of the retina.

The Cortex. The most striking feature of the normal lens is the segments producing what has been called the "Y." Variations in this are so numerous that it would be impossible for us even to group the types. The illustrations show some of the more common. A few distinct white dots may give the location of this interlacing, or the same kind of white specks may be surrounded by a nebulous, gray haze. There may be a feathery outline with central depression, or the folds at the junction may be so prominent as to give the impression of two fingers in apposition. The same changes are also evident in the posterior cortex except that the "Y" is inverted. In seemingly normal lenses we often find microscopic white spots. These are seen with the ophthalmoscope as minute black bodies, but frequently they are too small to be observed. They may be in any part of the lens, especially in the peripheral portions. When viewed in different layers from various angles and with contrasting focus, they probably give the impression that we receive of white rods, corkscrew filaments, wavy lines or even divergent fibers. The detail of these is not evident by any other method of examination.

Occasionally there are refracting bodies evident in the cortex without special regard to position, size or shape. These are called vacuoles, and their interpretation is still subject for discussion.

The earliest stage of advancing cataract formation seems to be the collection beneath the capsule, which has the physical characteristics of oil globules. There may be a single globule in the entire lens, or there may be so many as to cover the whole surface or even become confluent and appear as a film of oil. Whenever the normal arrangement of lens fibers is disturbed, either by the absorption of water or by some other chemical change, opacity develops. That there must be some other change is clinically suggested by the formation of the branching posterior cortical opacity that follows trauma. (Plate VI, VIa.)

Peripheral opacities are divided into two groups. With one a marginal base extends toward the pupil resembling a Gothic spire or stalactite. On close focusing, it reminds one of the cleavage lines through a transparent piece of ice because of its iridescent bluish-gray light and dark zones with indistinct outline, which involves many layers of the cortex. This type of cortical involvement shows very little tendency to progress, and has been known to remain stationary for many years. This is of the greatest clinical importance. No patient should be told that such spicules are cataracts for, strictly speaking, they seldom cause sufficient loss of vision to warrant the mental distress which follows such knowledge.

The other type consists of rounded, structureless, whitish masses, not limited to a single layer, and showing a noticeable tendency to enlarge into a progressive cataract in the true sense. These lardaceous accumulations may project from the entire periphery of the lens in various forms and sizes. Spicules and masses may be coexistent and, in addition, there may be many clear white lens dots scattered between them. Opaque patches may be found in any part of the cortex. These may be isolated and small without interfering with vision, or so large and so deeply placed as to cause partial blindness. These larger lesions usually occupy many layers, with streamers into the adjoining clear cells. The nuclear lens opacities are less definitely outlined than some others.

Dislocated Lens. The congenitally dislocated lens is usually clear, certainly so in early life, although associated lamellar cataract is noted. The lens margin, in contrast to the usual illustration, is crenated and does not have the clear, sharp edge heretofore depicted. The supporting zonular fibers are demonstrated as extending to the anterior and the posterior capsule, as well as lens margin itself. Traumatic dislocations, if not complete, show rupture of the zonular fibers. If dislocation is followed by marked inflammatory reaction, the pupillary area may be occluded and filled with brownish-gray exudate, behind which the lens may move. (Plate VII.)

Traumatic Cataracts. Traumatic cataracts are of several types, with two main subdivisions: one, in which the anterior capsule is perforated, and the other, in which the cataract seems to follow contusion. An example of the latter is the one that demonstrates the so-called Vossius ring, in which we have a very definite ring-like arrangement of anterior capsular opacities, minute and usually stationary, showing the outline of the pupil in capsular specks. The opening of the capsule in the other is followed by absorption of aqueous, causing a grayish swelling of the individual lens fibers with spaces between, probably fluid, and irregularly round collections without structure, the morgagnian bodies, and also the so-called oil globules. As the cortex expands, this gray material bulges forward into the anterior chamber, and breaks loose, and it is possible for us actually to see these lens fibers swell. If this distention is not too great and inflammatory reaction not severe, we know clinically that the entire cortex may be absorbed. Often, however, there are inflammatory symptoms with hypertension. At such times there is a considerable change in the iris pigment, and the gray masses are dotted with it. The anterior capsule may be suspended from above, and on the least motion of the eye wave as a white banner to and fro. A somewhat similar appearance of both anterior and posterior capsule may follow cataract extraction, capsulotomy or a penetrating wound. The posterior capsule may be intact and the whole surface covered with elevated, rounded, glistening, refracting spheres. Capsular shreds covered with fine pigment may be adherent to the vitreous. The vitreous occasionally comes through the opening. (Plates VIII, IX, X.)

Old traumatic cataracts show several types of change, one of distinct cortex absorption without the opening of the capsule, the lens becoming sclerosed and in parts even calcified. At other times, with the shrinking and absorption of cortex, the anterior capsule is folded on itself, showing as broad bands without regular arrangement. Then, again, practically all of the cortex is absorbed, and the anterior and posterior capsules are almost in apposition. The anterior surface of this conglomeration is pushed forward into the anterior chamber, projecting as a cone through the pupil.

The opening of the capsule and the retention of a foreign body often cause definite pigmentation. Siderosis may be extreme.

Lamellar Cataract. Lamellar cataract usually shows as a zone of opacity; it is accentuated, however, by increased density of some parts of the layer which outlines it. Triangles of gray may occupy both anterior and posterior limiting margins, and may even involve the center of this clouded area. The surface of the opaque region gives two sharp impressions, the one of gross stippling and the other of the very fine, barely perceptible lines. These types are unique. (Plate XI.)

The visualization of cataract formation is so real that, although heretofore the lens has been the most difficult part of the eye to study pathologically, it is now comparatively easy. To see a cataract develop in a recent detachment of retina proved a most instructive experience, for first there was a faint posterior vertical haze which increased in density and surface involvement, and then the anterior cortex showed many oil globules and fan-shaped opacities. Finally, the entire lens was milky white.

The economic importance of lens opacity is so great that any aid in the elucidation of cause must have an influence of wide range.

Removal of the Cataractous Lens by a Vacuum Method. There seems to be a tendency of late to break away from accepted customs and technic in the various branches of medical and surgical practice with the hope of advancement in the way of new treatments, operative procedures, etc., broached with the idea that there must be something radically wrong with the methods in common practice, and in some instances, with total or partial disregard of the safety factor as applies to the patient. Proved methods are discarded for the more spectacular until a time comes when the novelty of the thing ceases to exist as a compelling agent in stimulating our desires for something new, and we drift back into our tried and proved ways to reflect while awaiting the next outburst of enthusiasm.

The removal of the cataractous lens in capsule seems to be one of these periodic outbursts, most interesting to accomplish, fascinating to watch, when all goes well, and decidedly not so fascinating when vitreous stares one in the face as a mute reminder of the dangers confronting us in our pursuit of the spectacular.

When one sees eighteen cases of cataract operated upon intracapsularly and vitreous lost in one-third of these operations, the latter having been done by one who is a past master in this particular operation, one must necessarily form an unfavorable opinion as to the advisability of adopting such a procedure as a routine for the relief of our cataract patients as we know them in our own localities. We expect to meet our patients at any future date and the spectacle of broad operative colobomata, updrawn irides or possibly empty sockets, is not one to cause us to retire with a clear conscience.

Regardless as to how lightly loss of vitreous is held by the operators who employ this method, it must be admitted by anyone who has followed up hospital work that it is a serious consequence to be reckoned with as regards the future welfare of the operated eye. When vitreous is lost the eye suffers; if not at the immediate period following operation, then at a later period when degenerative changes may show themselves as a reminder of what has gone before.

When Barraquer demonstrated his vacuum method of removing the cataractous lens intracapsularly, the whole procedure was seemingly so much more in keeping with the safety factor and the technique so brilliant, that one marveled at the excellence of his work. Three cases were operated upon. Two of these cases were done without difficulty, but in the third the capsule ruptured, making it necessary to resort to the lens curette. In spite of this mishap Barraquer cleaned out the cortical matter nicely after drawing the lips of the wound together with the stitch which he employs before removing the lens. The introduction of this stitch in all his cases proves conclusively that trouble must be expected and he prepares himself for this eventuality by inserting but not drawing up, the suture through the center of the lips of the wound, tying after the lens is delivered through the loop of the stitch.

There is no gainsaying the fact that the Barraquer operation, when all goes well, is a beautiful thing to witness; but it is fraught with dangers, making it an operation not on a par, from a safety standpoint, with the regular combined extraction.

Frank C. Parker[8] has done fourteen of these vacuum extractions by a modification of Barraquer's procedure and he cannot conceive how it or any other intracapsular operation will ever be adopted by the majority of operators as an accepted mode of extraction.

Considering intracapsular methods the author goes on to say that as compared with the combined extraction, he does not think there are many ophthalmologists who, after seeing these operations, would consent to have a member of his own family operated upon intracapsularly. The risks are too great. Then, just what is gained? Nothing but the elimination of the needling, and who would object to this latter procedure?

In the fourteen cases (intracapsular) done by a modified Barraquer method using buccal "suction," three cases lost vitreous, one showing an escape of about half a dram; another lost an amount as described by the intern, of a volume equal to one and a half times the size of the lens, while the third lost an equal amount of straw-colored fluid vitreous. A certain amount of practice and familiarity must be attained before the best results can be attained.

As to the operation itself: Barraquer employs quite a formidable, complicated although ingenious, apparatus for creating the vacuum. This apparatus in itself

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(8) Atlantic Med. Jour., March, 1924.

seems to be a nightmare to any who essay the procedure. However, the apparatus is very cleverly constructed and works well. The thought occurred to the author while watching Barraquer operate, that a lens capsule would withstand only so much of a pull before giving way and the apparatus appeared to be so powerful for such a small task that it was estimated that more than enough vacuum could be secured by buccal "suction." If the aforesaid be true the cumbersome piece of apparatus could be discarded.

Accordingly a vacuum hand piece was secured, comprised of a tube with a shallow cup on one end. To the opposite extremity a small rubber catheter was attached, holding a section of glass tube as a mouthpiece. The usual incision was made, possibly somewhat larger than ordinary, and the iridectomy done. The cup was introduced into the anterior chamber and carefully slid beneath the iris so that close application was secured to the lens capsule. By creating a vacuum using buccal "suction," the lens was withdrawn without difficulty.

Using an open tube in this manner, should the lens become dislocated and a second attachment sought, one could readily see how easy it would be to evacuate the entire contents of the eyeball in a brief space of time. One slip-up would cause vitreous to come through the tube without any means of stopping it, save a discontinuance of the vacuum, but by this time too much damage would have already been done before one could check the force withdrawing the vitreous, especially should the latter be fluid. This glaring danger led Parker to construct the instrument here described.

The apparatus may be compared to a medium-sized hypodermic syringe, the needle being replaced by a larger tube, at the far end of which is attached a vacuum cup of approximately five millimeters in diameter and two millimeters in depth. The cup has a slight flare, permitting easy introduction through the corneal incision and also allowing an easy insertion of the cup between iris and lens. If this cup is not flared at the margin, difficulty will be experienced in introducing the instrument into the anterior chamber and sliding it beneath the iris. One can readily see just

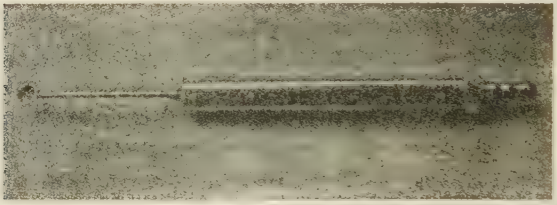


Fig. 2.—The Duo-Vacuum instrument.

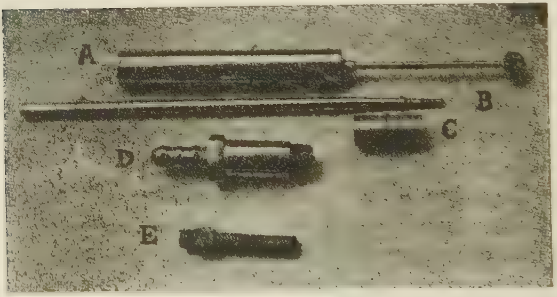
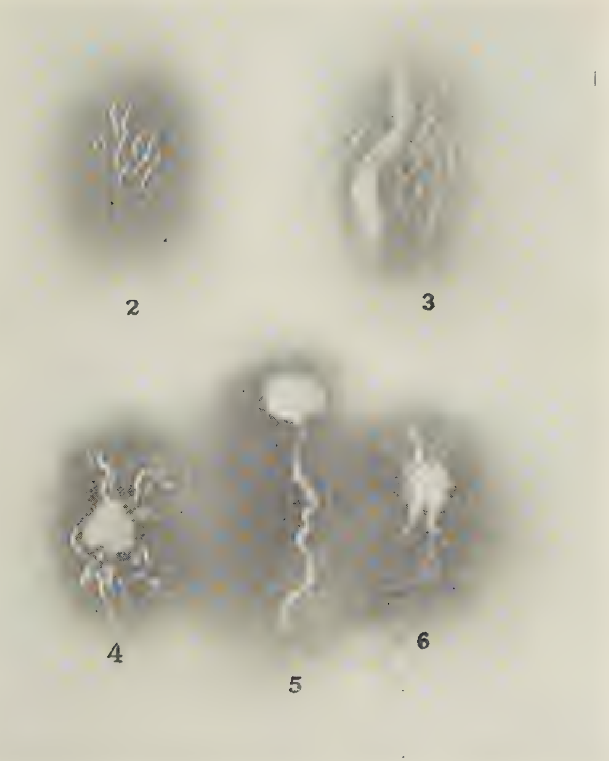


Fig. 3.—Duo-Vacuum Instrument. A—Barrel and vacuum cup. B—Rod for removing plunger. This rod screws into the plunger C for purposes of removal from barrel. C—Plunger which slides in barrel. D—Cap fitting on end of barrel. E—Screw stop attached to cap D and used to regulate distance through which plunger moves. ment of plunger.

what would happen should a vacuum be created while the instrument was over, instead of beneath, the iris and not properly engaged on the surface of the lens capsule.

PLATE V.



2, lens dots; to the left hand side dots in the normal lens, to the right hand side an impression of the wavy lines in seemingly normal lenses; 3, capsular bands. capsular folds filling the pupillary area; vision, full normal; 4, 5, 6, posterior capsular cataract: posterior capsular opacities which ophthalmoscopically show as small black pin points; the tail is a distinct hyaloid remnant.—Bedell, page 102.

PLATE VI.

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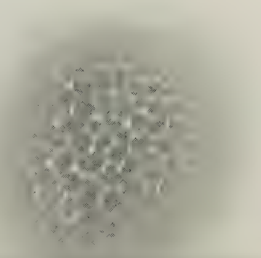

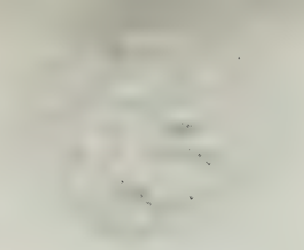

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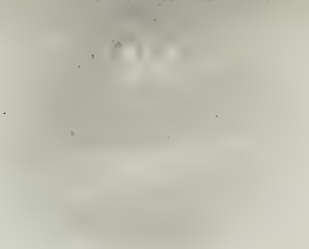

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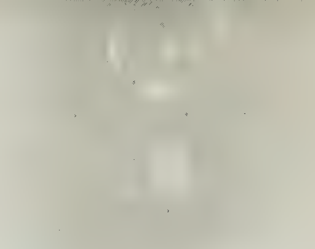

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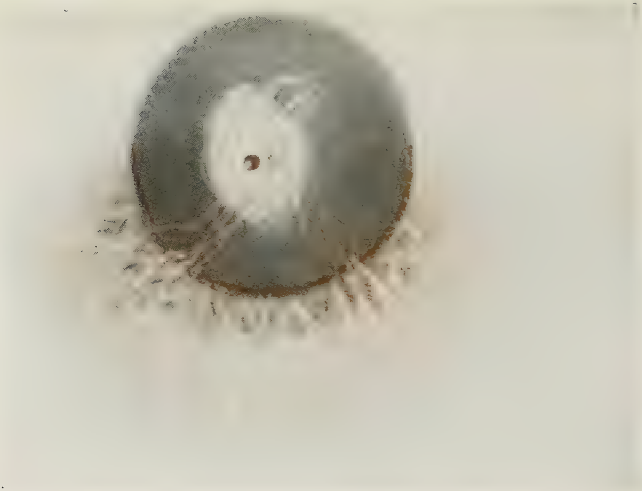
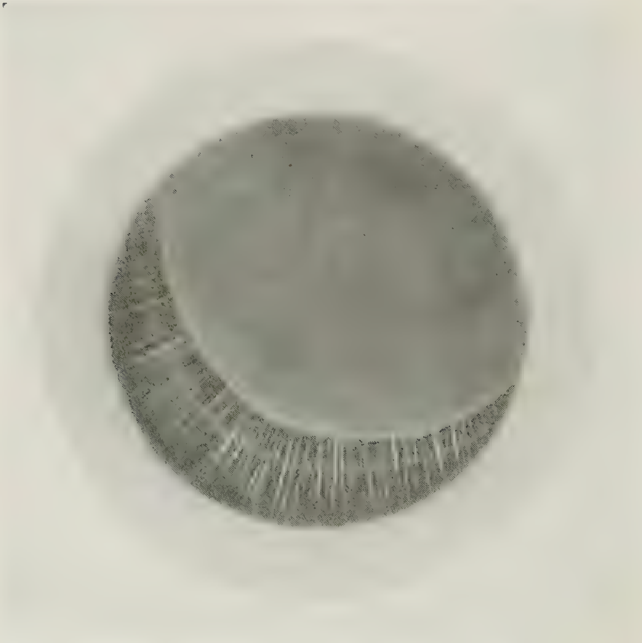
4, "Oil" globule beneath the anterior capsule in advanced cortical cataract; 5, 8, post-operative, wavy, anterior capsular folds; 7 anterior capsular membrane; 10, swollen gray lens in progressive cataract; 11, with cortical opacity; 6, 9, 12, variations in the normal "Y" not discerned except by slit lamp. No change in vision.—Bedell, page 102.

PLATE VII.

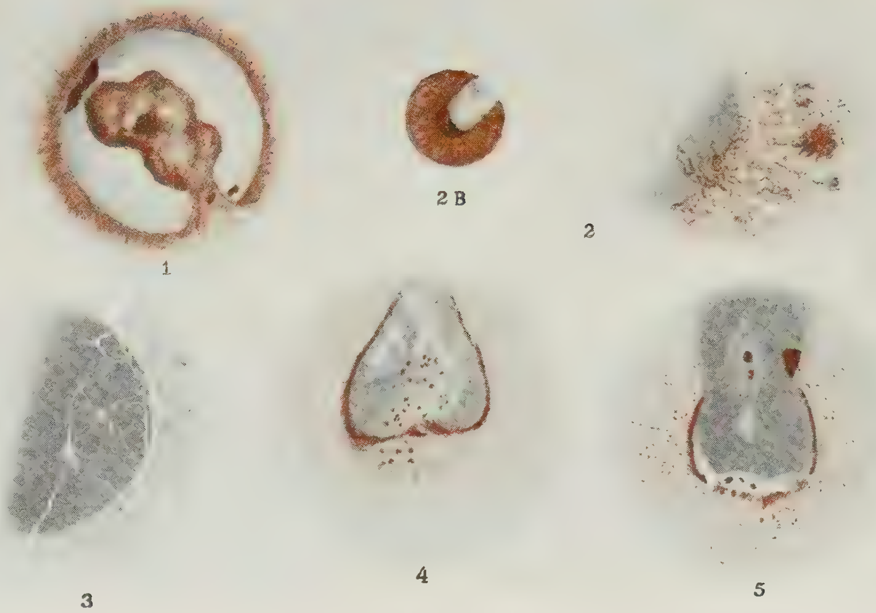


Anterior capsule cataract. Bedell, page 102.



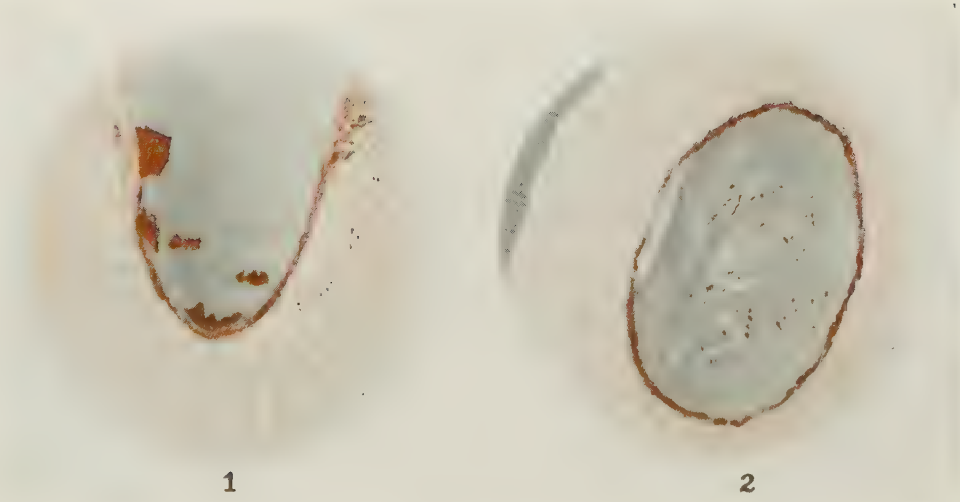
Congenital dislocation of lens.—Bedell, page 102.

PLATE VIII.



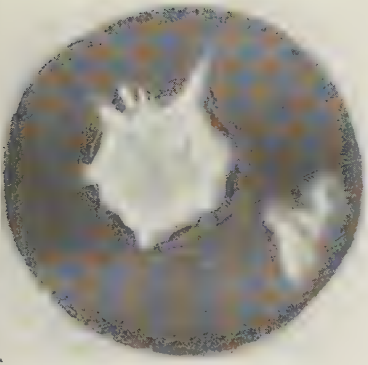
1, Traumatic cataract; secondary iridocyclitis; 2, 2B, dislocated lens; sympathetic inflammation; 3, persistent pupillary membrane; capsule opacity; 4, complicated cataract; 5, chronic glaucoma.—Bedell, page 102.

PLATE IX.



1. Chronic inflammatory glaucoma; 2. iridodialysis, traumatic cataract. Bedell, page 102

PLATE X.



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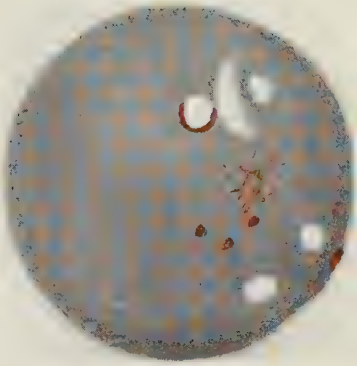

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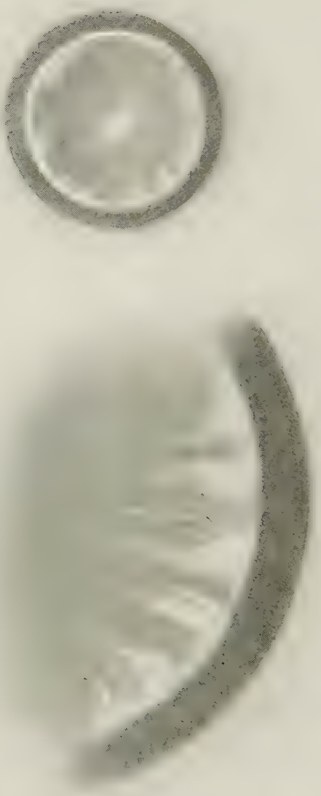
1. Traumatic cataract; exudate; a mass of capsular and subcapsular exudate giving the impression of traumatic cataract; the peripheral projections are cortical changes; 2, congenital lens opacities; congenital changes, including capsular pigment of two types, the branching cells and rounded masses, the lamellated sphere is capsular with a partial circle of fine pigment dots; the other opacities are cortical; there is no tendency to increase in size; vision normal; 3, progressive cortical cataract: it is difficult to show three definite layers of cortical involvement; the upper left is subcapsular and the center deep cortical, with a layer between occupied by the small opacity.—Bedell, page 102.

PLATE XI.



Lamellar cataract.—Bedell, page 102.

Within the barrel of this syringe is a plunger which fits snugly yet slides freely. This plunger is about fifteen millimeters in length and has free motion from one end of the barrel to the other. Upon creating a vacuum by means of buccal ''suction'' or by employing a pump, this plunger draws away from the cup end of the barrel creating a second vacuum which acts upon the lens capsule. The two vacua are in no way communicating, being separated by the interposed plunger. This prevents any fluid from passing through the instrument from the eye or *vice versa,* regardless of the strength of vacuum created.

As it is unnecessary to utilize the full capacity of the barrel, a threaded tube is incorporated within the instrument which acts as a stop and allows of any adjustment to stay the movement of the plunger. If the plunger is adjusted to move about five to eight millimeters, the vacuum created is sufficient to withdraw a lens.

The object of the plunger is twofold. First, it acts as a regulator of the cavity produced and secondly, should the instrument be plunged directly into the vitreous, no more of the latter could be withdrawn than would fill the small cavity left by the movement of the plunger. In fact healthy vitreous will hardly pass through the needle-like tube, another safety factor.

When the plunger is correctly adjusted, it is impossible to withdraw more than one or two minims of vitreous under the most adverse conditions. This is in marked contrast with an open tube instrument where the whole contents of the globe can be withdrawn at one pull. Several of these vacuum instruments that have been devised are of such size that nothing could prevent a catastrophe should a slip occur.

To allow of sterilizing and cleansing, the barrel is made in two sections which may be unscrewed and the plunger removed by inserting a small threaded rod supplied for the purpose.

The construction of the instrument makes it possible to utilize any of the vacuum pumps now employed by nose and throat men as an excess of power need not be feared.

In Barraquer's instrument a vibratory motion is imparted to the lens with the idea that the zonula is more easily ruptured. No vibratory motion is necessary for dislocation and may do more harm than good.

As to using this instrument, the author's procedure has been to make the regular incision, possibly larger than ordinary, bearing in mind that the lens must pass in its entirety. A conjunctival flap may or may not be used, according to the operator's preference. The incision made, a small iridectomy is done. The vacuum instrument is now inserted through the lips of the wound and beneath the margins of the iris so that the cup lies in close proximity to the anterior capsule, the handle of the instrument being held midway between the vertical and horizontal axes of the cornea. After making sure that no iris is caught between cup and lens, and that good contact is had, the vacuum is applied by drawing through the rubber tube attached to the instrument, and held in the mouth. Now by tilting first downward, causing pressure to be brought into play upon the lower half of the zonula, followed by a rocking motion on the horizontal axis of the lens and transferring the pressure to the upper half of the lens, the latter is dislocated. Continuing this pressure and at the same time turning the instrument over, the cataractous lens is withdrawn, the cup beneath and the posterior surface of the lens in contact with the cornea.

No sutures are employed. The pillars of the coloboma are replaced by the spatula, atropin instilled, bichloride salve applied to the closed lids and bandage put on.

It seems to make little difference whether the eye is dressed on the second, third or any later day as far as healing is concerned. No particular advantage is seen in opening an eye too soon when no symptoms present themselves to demand it. We do nothing but satisfy our curiosity in meddling with an unhealed incision and it is best to wait until the third day for the initial dressing. Of course, should the patient exhibit signs of pain or discomfort we may suspect something to be developing which would require an inspection of the wound. In this case it is justifiable to open at any time. The author does not wish to be considered an advocate of any intracapsular operation. From what he learned from personal experience he feels that when such excellent results may be had by employing the regular combined extraction with or without the subsequent needling, any operation which increases the dangers so markedly and offers no better or not as good end results, must be condemned absolutely. He hopes that the instrument described will make the road easier for those who will endeavor to use the intracapsular operation, as many will continue to do, until their better judgment tells them otherwise.

Intracapsular Cataract Extraction with the Report of Thirty Consecutive Operations. In a summary of thirty extractions of senile cataract by Phacoerises, among Philippine patients, Ubaldo and Fernando[9] present the difficulties encountered by this method as compared with those under the "Indian-Smith" method. They believe that intracapsular cataract extraction offers certain distinct advantages over the simple extracapsular extraction. Of the two methods of intracapsular extraction (the Indian-Smith and

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(9) Amer. Jour. Ophth., August, 1924.

Barraquer's) which one should be of preference? Some years ago Ubaldo tried the Indian-Smith technic on several cases, but it had to be abandoned because of too much loss of vitreous which attended almost all of his cases. From the experience with these two methods these observers are of the opinion that with due care Barraquer's technic offers less danger of vitreous extrusion than the other, and the result in vision is much more satisfactory. Of course this operation is difficult to perform, but cataract operation by any method demands great skill, if one expects good results. With the acquisition of more experience, and with more confidence in this technic and careful study of every step or detail in the operation, as emphasized by Barraquer, our results would be much better. The following should be given full consideration by one using this technic:

First. Barraquer lays much stress on the preliminary and thorough examination of each individual case to determine the condition of the cataract. According to him the vacuum to be used must depend on this condition of the cataract and of the zonula fibers in order to properly deliver the lens. And in his own words: "Only practice and a thorough and prolonged previous examination of the physical condition of the zonula and the lens can enable us to determine the degree of vacuum to be employed."

Second. Care must be taken that before suction is employed the platinum cup must have every point of it in coaptation with the surface of the lens, for otherwise aqueous, blood clots, or even vitreous may be aspirated.

Third. Care must be taken that the lower edge of the crystalline lens follows the curve of the patellar fossa, without the slightest pressure upon the surface of the hyaloid membrane; and that the posterior surface rubs against the scleral lip of the wound.

Fourth. It is essential, of course, that the apparatus be scrupulously examined to see that it is in an excellent condition.

The various results of these thirty cases were:
Vision 20/40—5 cases.
Vision 20/50—7 cases.
Vision 20/70—6 cases.
Vision 20/100—3 cases.
Vision 20/200—6 cases.
Vision counting fingers 3-14 feet—3 cases.

The Medical Treatment of Cataract. Inglis Taylor[1] remarks that for years ophthalmic surgeons have been striving to find some means of curing, or at least delaying, the advance of cataract beyond the stage when work must be given up, and financial conditions make its continuance imperative. Until fairly recently the author was very skeptical that such a desirable end would be attained, but now, due to the exertions of Badal, Dor, and others, working on the same lines, he expresses a strong opinion in its favor.

Badal began with the assumption that cataract was due to a dehydration (sclerosis) of the lens, and used iodine in alkaline solution as a collyrium, and later for ocular baths, with some success. Dor, in 1919, demonstrated that cataract is the result of hydration of the lens, the hydration being due to the fact that the blood contains hydrating ferments, such as occur in the blood-serum of rabbits when naphthalin is ingested, and in the serum of certain diabetics; in both conditions the frequency of cataract is well known. Dor's treatment, therefore, consists principally in adding the dehydrating action of calcium to the lignifying and other actions of iodine. This preparation was still used as an eye-bath until Chauvin, director of Blache Laboratories, brought it out in the form of an ointment, under the name of calcic-alkaline iodide, and in this form it is now used. As a bath it fre-

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(1) Eye, Ear, Nose, and Throat Monthly, May, 1924.

quently caused irritation, and the treatment twice a day, continued if possible for half an hour each time, was very irksome.

The ointment is in most cases quite painless, and should be so, but like badly mixed hydrarg. oxidi flav. it can be very painful; when pain occurs the tube should be changed for another. Naturally, the more incipient the cataract when brought under treatment the more easily is it absorbed, but it must not be thought that only these very early cases are successfully treated. Though strongly commending the treatment, Taylor has had too much experience in operating to have any doubt that absorption is not the treatment for an advanced case, nor is it claimed that the treatment should be used in such cases. All told, he has had about 20 cases under treatment, but all of these cannot be counted as a fair indication of the merits of the treatment, as at first Taylor was inclined to try the effect on cases which were too advanced. Another cause of reduction in numbers was the want of faith in trying a new remedy, of the medical profession, ophthalmic and otherwise. Patients applied to their general practitioners or through a friend to the friend's oculist, and were informed there was no cure for cataract except operation. They naturally ceased to attend, and now have the weariness of waiting. Of the rest treated, four or five have full vision, and the others are in various stages of improvement.

THE OPTIC NERVE.

An Anatomical and X-ray Study of the Optic Canal in Cases of Optic Nerve Involvement. One is often asked why one person out of many having infections should lose his vision while others escape, and why one person should remain permanently blind and another recover spontaneously. L. E. White[2] attempts to answer these queries.

That the osseous canals normally afford great protection to their neural contents cannot be doubted, but when these canals become narrowed and the enveloping sheath of the nerve, or the nerve itself, swollen, the unyielding walls may cause constriction sufficient to produce atrophy. While this fact has been generally recognized, the size of the canal has received scant attention. The author has been able to find but little evidence of pathology adjacent to the optic canal in the *x*-ray plates. Probably this is due to the types of infections responsible for the neuritis in the cases observed since this study was commenced, as these happened to be largely from tonsil infection. It has been rarely possible to discover acute infections within the posterior sinus by the *x*-ray, while in the chronic cases which show pathology in the film, nature has walled off the infection from the nerve.

The important thing to determine in a study of the optic canal is its size and shape, as this is always possible. Adjacent pathology while always sought is not so easy to determine and many cases undoubtedly require surgical interference where it is not evident.

The normal optic canal is practically 5.5 mm. in diameter. It varies from 3.5 to 6.5 mm. Extensive pneumatization about the canal is usually associated with narrowing. When the lesser wing above the canal is more extensively pneumatized than other regions, the canal is flattened on top. If the region beneath the canal is also pneumatized it becomes oval, while in the rather rare instances where the bridge formed by the lateral root of the lesser wing of the sphenoid is also pneumatized, it assumes a somewhat triangular shape. Any irregularity in the contour of the canal from what-

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(2) Boston Med. and Surg. Jour., Nov. 15, 1923.

ever cause produces a diminution in its caliber, and renders its contents more susceptible to infections from the sinuses surrounding it. It seemed to be a fairly constant rule that the smaller the canal the more extensive the pneumatization. It should also be emphasized that small canals may be round, even though surrounded by pneumatic sinuses so that the shape while not all important usually indicates susceptibility to infection. The films of the canals many times are misinterpreted due to faulty position. The image of the canal should always appear in the lower outer quadrant of the orbit. While the films of only about thirty patients with optic nerve involvement have been studied, the conclusions from these indicate that the smaller the canal the more the danger of permanent loss of vision and the greater the necessity for operation. The size of the canals is most valuable in making a differential diagnosis, for large canals immediately lead one to look elsewhere than in the accessory sinuses for the cause of the amblyopia. This has already proved of great value in two recent cases,—one due to multiple sclerosis and the other to an enlarged pituitary, although both cases had marked pathology in the nose. If future cases substantiate the findings in those already studied, it will mean that a canal of 4 mm. or less in a case of severe optic nerve involvement indicates the necessity for immediate ventilation of the posterior sinuses to prevent permanent atrophy, unless some other definite focus can be found. A 4.5 mm. canal gives greater leeway for study and investigation. Optic atrophy is less to be feared. A 5 mm. canal would probably recover from almost any *acute* attack either spontaneously or under local treatment. Then if some focus of infection is found, diseased teeth or tonsils for instance, it should be removed as a preventive to recurrences.

Ocular Phenomena Produced by Intra-Cranial Lesions Involving Optic Tracts Near Chiasm. Walter I. Lillie[3] has studied cases of intra-cranial lesions affecting the chiasm in order to ascertain whether an ophthalmologic method of examination could be found to enable the ophthalmologist to determine more definitely the origin or position of the lesion.

The cases reported have been classified into four groups, according to the origin of the lesion, in order to show the striking similarity in the ocular phenomena and the changes in the sella turcica as revealed by the roentgenogram. The four groups are:

Group 1. (*a*) Pituitary tumors without glandular disturbances; (*b*) pituitary tumors with acromegaly. and (*c*) pituitary tumors with diabetes insipidus.

Group 2. Intra-cranial tumors, not of pituitary origin, affecting the chiasm.

Group 3. Nasopharyngeal tumors affecting the chiasm.

Group 4. Syphilitic basal meningitis affecting the chiasm.

He arrives at the following conclusions:

1. All but four of the sixty-four patients had some change in visual acuity of one or both eyes.

2. The patients in whom the optic discs were normal in appearance, or who had pallor of the disc without loss of substance, obtained the greatest gain in visual acuity and perimetric fields following surgery.

3. In practically all cases, the scotomatous field changes were, at one time or another, continuous with the physiologic blind spot, and the blind spot was almost always incorporated in the temporal field defect, either for form or for color.

4. The presence or absence of color or field defect was as important as that of form defects.

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(3) Jour. Amer. Med. Ass'n., Nov. 24, 1923.

5. The roentgenograms of the sella turcica were normal in a higher percentage of cases with intra-cranial lesions, not of pituitary origin, than in those of pituitary origin.

6. All persons suspected of having intra-cranial lesions affecting the chiasm should have thorough nasopharyngeal examinations.

7. The origin of lesions affecting the chiasm cannot be definitely determined from ophthalmologic examination.

GLAUCOMA.

Some Phases of the Glaucoma Problem. The observation that the condition of glaucoma is so frequently overlooked not only by the general practitioner, but also by men professing to practice ophthalmology, and even when recognized or suspected, is so frequently neglected or imperfectly treated, has prompted W. H. Wilder[4] to offer a few remarks on this subject that has been such a favorite theme for study and writing of ophthalmologists.

It is hoped that some observations on the subject that have been impressed upon the author after considerable study of such cases and experience in their treatment, may stimulate some of the younger men to more careful study and examination of this really difficult subject.

In considering the subject of glaucoma we should get away from the idea that has so long obtained and that is still held in most text-books, that we are dealing with a disease entity.

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(4) Minn. Med., May, 1924.

While the glaucoma is indicative of an abnormal condition of the eye, it is more accurately a syndrome, a symptom complex, the chief feature of which is intra-ocular pressure.

The accumulated experience and observation of many students of this subject demonstrate the complexity of the pathologic condition that may underlie glaucoma.

The division into inflammatory and non-inflammatory, acute, sub-acute, and chronic or simple forms is the natural sequel of considering the condition as a disease *per se* and is confusing. Much to be preferred is the simpler nomenclature of congestive and non-congestive forms adopted by Elliot and other writers on the subject. Non-congestive forms, as we know, may, under favorable conditions, become congestive.

Hypertension, increased intra-ocular pressure, is universally recognized as the dominant feature of this condition and the one that demands our closest attention in the study and treatment, but underlying this may exist pathologic changes and conditions so diverse and complex as to defy our efforts to elucidate them.

In the study of the etiology of glaucoma we are confronted with difficulties from the outset. A knowledge of pathological anatomy assists in the study of pathogenesis. In this subject, the lack of material for studying the earliest stages of glaucoma increases our difficulties. Most of the glaucomatous eyes that come to section are those in the latest stages, and we are not warranted in concluding that these conditions found are those of cause and not of effect.

We are all familiar with most of these changes or at least with the most prominent ones.

The shallow anterior chamber, the filtration angle blocked by the root of the iris, the atrophied iris, the swollen ciliary processes, edematous cornea, the engorged ciliary vessels, the cupped optic disc, the cavernous atrophy of the optic nerve, all these and more have been accurately and carefully observed. But it is difficult to answer the question: "Are these the cause or the effect of the increased intra-ocular pressure?"

There is little doubt that age is an important factor in the etiology. It is a common observation that most cases of glaucoma occur in middle and late life, and statistics confirm this.

For instance, in the analysis of a series of 1,032 cases of primary glaucoma Haag found that four occurred in the first decade of life, 16 in the second, 26 in the third, 74 in the fourth, 176 in the fifth, 288 in the sixth, 239 in the seventh, 116 in the eighth, and three later.

These figures are in accord with the observations of Priestley Smith on a series of 1,000 cases collected from the practice of a number of surgeons.

But in what way does age influence the intra-ocular pressure? Priestley Smith, one of the most profound students of this subject, has shown that the lens grows larger with advancing life while the size of the eyeball remains the same or possibly becomes somewhat smaller. He claims to have demonstrated that the ciliary processes are more prominent and bulky in the old than in the young. With the increase in size of the processes and the lens, the circumlental space is correspondingly narrowed so that fluids cannot so readily pass from the vitreous into the aqueous chamber.

In consequence, the lens and swollen ciliary processes are pushed forward against the iris, the root of which blocks the filtration angle and thus impedes or stops the outflow of fluids through the spaces in the pectinate ligament. Of course this would explain the shallow anterior chamber which is one of the well recognized signs of an established glaucoma.

Thickening or sclerosis of the fibers of the pectinate ligaments as pointed out by Henderson may contribute to this result. As a consequence of such thickening, which may be one of the manifestations of fibrosis incident to advancing life, the lymph spaces in this structure may be seriously contracted so as to be inadequate for the circulation of the lymph.

Valuable as is the knowledge of these factors in the production of glaucoma, the ultimate cause is not yet known. What brings about the enlargement of the ciliary processes? Is such an enlargement in the nature of an inflammatory condition? Is there associated with it an increased secretion of fluids which the circulatory system of the eye is unable to take care of, thus raising the intra-ocular pressure? If there is an increase of fluids in the eye are they in any way changed in their physical or chemical nature? What rôle do vaso-motor disturbances and nervous irritations, so common in the period of life when glaucoma occurs, play in the problem? Do degenerative changes in the uveal tract, particularly the ciliary body, bring about increased or altered secretions in the eye? What influence do various morbid states that result in auto-intoxication have in bringing about such degenerative changes in the ciliary body?

These and various similar questions are engaging the attention of the students of the subject and have not yet been satisfactorily answered. Possibly they may never be answered, associated as they are with some of the most intricate problems of metabolism.

In truth, the etiology of glaucoma is hydra-headed. In the last few years writers on the subject seem to have found reasons for denying any causative relation between arteriosclerosis and glaucoma. One cannot escape the thought, however, that a condition like arteriosclerosis that so profoundly affects the welfare and nutrition of tissues that play a rôle in bringing about degenerative changes in the eye, particularly if the ocular vessels are so affected, that may lead to the results that we are considering, viz.: hyper-secretion of fluids and alteration of such secretions. Of course, this is, at present, mere speculation.

Appropriate in this connection are the admirable words of the late S. D. Risley on the subject of etiology: "Glaucoma is a disease, coming on at an age when wear and tear, harassing vicissitudes, misfortunes, exposures, overwork and vicious living have sapped the physiologic foundations of life; when infections have found entrance to the structure of the organism through the doorway of the epithelium; and when a variety of toxic, auto-intoxic and other influences have set up vascular and cardio vascular disease, associated nephritis, uveitis, high blood pressure, etc. Glaucoma, in fact, rarely occurs in individuals in good general health."

The diagnosis of congestive glaucoma should not be difficult even in the early stages, when we consider the distinct signs that it presents. And yet we can all recall deplorable cases that have been overlooked by the optometrist, and also by the general medical practitioner, in which the eye has been greatly jeopardized or possibly lost in consequence of such an error. Ignorance in regard to this dreaded condition should not exist. General physicians should be impressed with the importance of the early recognition of it, and, although they may do no ophthalmic work, should be able to recognize it, or at least in more insidious cases to suspect it and to refer the case to the specialist for exact diagnosis.

Errors of recognition are not necessarily due to ignorance, but may result from oversight because of the multifarious duties the general practitioner must assume. Such experiences are not uncommon and suggest the importance of impressing upon the general physician the necessity of examining the eyes as a part of his general examination of a case.

No difficulty should be encountered by the specialist in the diagnosis of congestive glaucoma especially if it is once established or is in an acute stage. The signs and symptoms, all produced by the increased intra-ocular pressure are so familiar to us that they scarcely need more than enumeration on this occasion: steamy, insensitive cornea occasioning rainbow phenomena around lights; faint ciliary congestion in acute stages and engorgement of ciliary veins that penetrate the anterior portion of the cornea; shallowing of the anterior chamber and oval enlargement of the pupil; more or less haziness of the media in consequence of which and also in consequence of the pressure on the retina there develops impairment of central and peripheral vision; if the condition has existed for any length of time, more or less cupping of the optic disc with possible pulsation of veins or arteries or both; in the acute stages, because of the haziness of the media, impossibility of seeing the details of the fundus; pain of varying degree, according to the intensity of the acute attack, sometimes in the eyeball, sometimes simulating a facial neuralgia, or occasionally dull and ill-defined, or of a nature reflexly to excite nausea and vomiting; and marked hardness, increased tension of the eyeball as determined by palpation or with instruments. All of these signs and symptoms form a clinical picture that the specialist readily recognizes as acute or congestive glaucoma. There may have been prodromal signs before the attack, but the glaucomatous condition even then must have been present.

It is in the non-congestive forms of glaucoma that problems of diagnosis present that are often difficult to younger practitioners in ophthalmology, particularly in those cases of so-called simple glaucoma, in which the intra-ocular pressure is not at all times measurably increased. These are the cases that frequently puzzle us in diagnosis and raise questions as to treatment. Frequently they present little or no impairment of central vision; the onset of increased intra-ocular pressure has been insidious and its progress slow. The first intimation of anything wrong may be the discovery in the routine examination of a cupped disc, and then further examination elicits the glaucomatous condition. Or the patient may complain of dull pain, again of neuralgic pains in and around the eyes at times, blurring of the vision when reading as if his glasses do not fit. Such symptoms may indicate disturbances of accommodation from congestion of the ciliary body, or disturbance in the refractive power of the lens from increased pressure. It may occur in myopes as well as hyperopes.

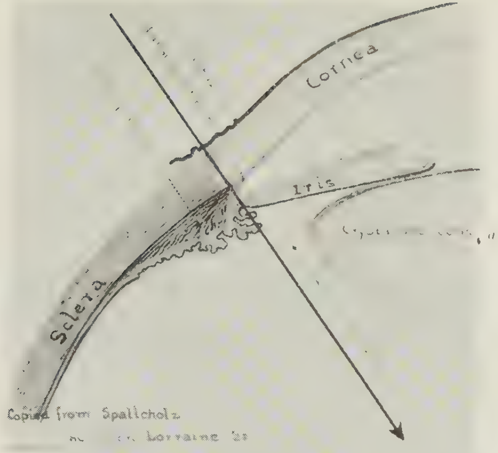
Probably in these cases of so-called simple glaucoma the increase in tension is not constant, but intermittent. Before the days of more accurate testing of tension with the tonometer, there was question as to whether many of these simple glaucomas manifested any increased tension, it being too slight to be noted by digital examination, but careful tests with the tonometer reveal that, at times, increased tension exists.

It is in such cases that we must arrive at the diagnosis by a study of the visual fields, the central vision, the appearance of the optic disc and a record of the tension as taken with the tonometer at various times.

The fields for white and colors, particularly red and green, should be taken, not once, but frequently, to record the progress of the case. They should be taken by the same observer each time, and as far as possible under the same conditions as to light, environment, background, etc., for there is no examination that admits of a greater chance for error on the part of both patient and observer than a perimetric examination of the visual fields.

We are all familiar with the various irregularities and contractions of the fields that are present in simple glaucoma, but certain features stand out prominently enough to make definite characteristics. The contrac-

PLATE XII.


Cornea
Iris
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a
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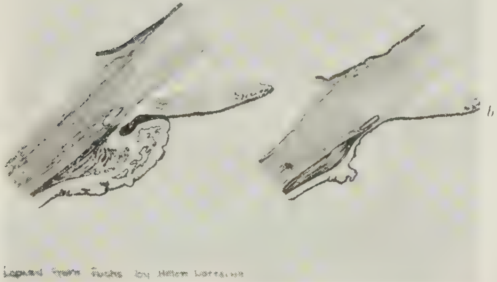
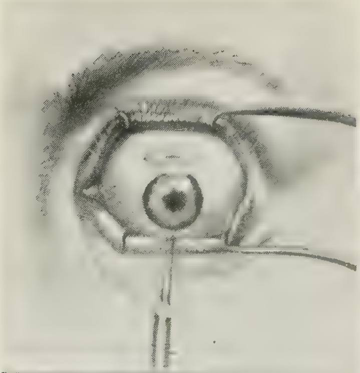
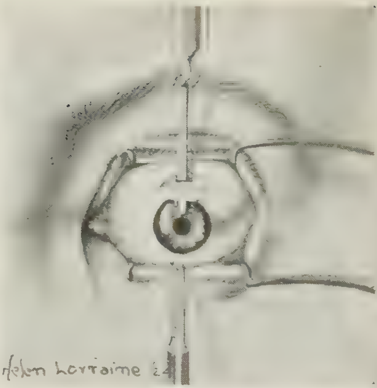
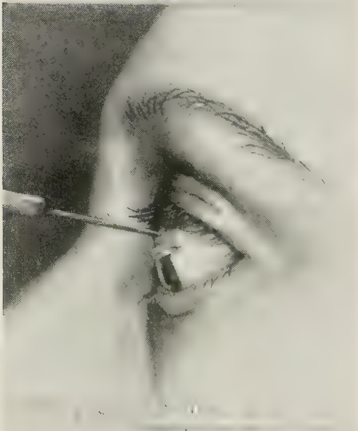

b
Copied from Fuchs by Helen Lorraine

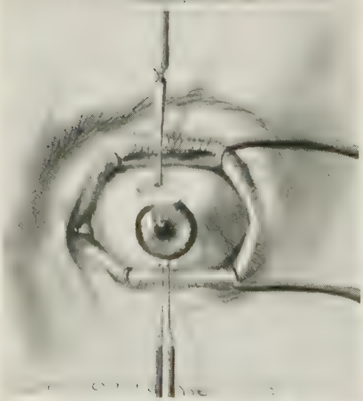
a—Drawing from a section of a normal human eye (after Spalteholz). The arrow indicates direction of incision for sclero-post-iridectomy, and shows the feasibility of the incision without danger to important tissues even in a normal eye. In a chronic glaucoma, with atrophied ciliary body, much more room is available for the incision.

b—Comparative drawings of ciliary area (after Fuchs) showing ciliary body in congestive glaucoma and in simple chronic glaucoma. —Jervey, page 131.









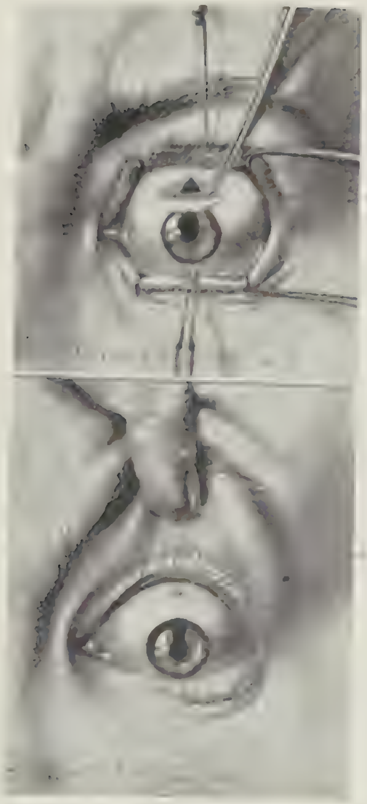
a—Showing conjunctival flap turned down over cornea, and shorter scleral incision 2½ mm. above corneal limbus.

b—Showing direction of scleral puncture and incision with Graefe knife. (The eye speculum was unintentionally omitted from the illustration.)

c—Hook passed through scleral incision, between iris and lens, and engaging upper pupillary margin of iris.

d—Spatula entering anterior chamber through scleral incision, separating the adherent iris from inner surface of sclera and cornea, thus uncovering the pectinate ligament and Schlemm's canal. (This step was not used in the series of operations reported here. It has been adopted since with satisfaction.)—Jervey, page 131.

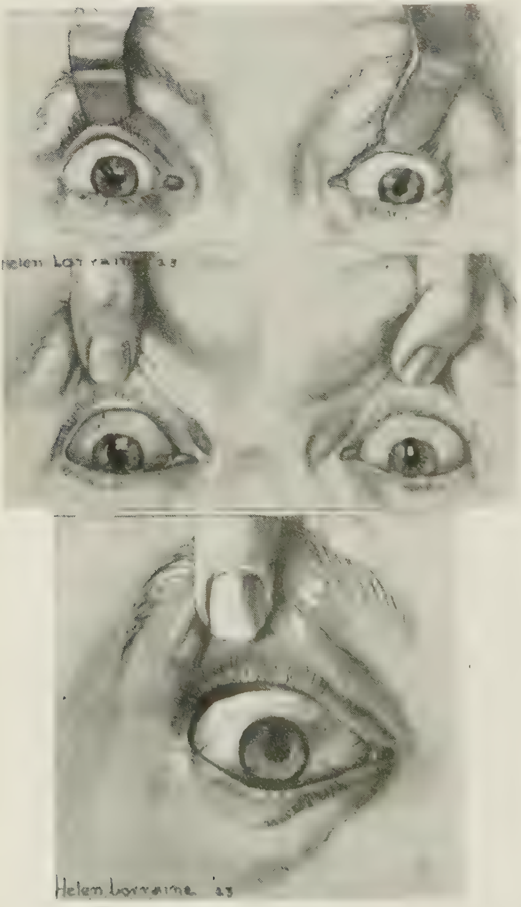
PLATE XIV.



a—Iris withdrawn on the hook and scissors in position to complete the sclero-post-iridectomy.

b—Operation completed and conjunctiva drawn back in place and sutured over scleral incision.—Jervey, page 131.

PLATE XV.



a—Drawn from life, the right eye two years and the left three years after operation. Colobomas up and out, operation having been done with straight-shank iris hook, before special hook was devised. About one year after the sclero-post-iridectomy in the right eye, cataract extraction was done, entirely without unusual incident, and with resulting vision, with correction of 20/20. The coloboma is covered by opaque capsular membrane, the pupillary area proper being clear.

b—Drawn from life, right eye 26 months after operation, left eye 14 months after operation. Pigmented spot above each cornea marks site of scleral entrance. Operation on right eye, with coloboma up and out, was done with a regular straight-shank blunt iris hook; in the left eye the specially devised hook was used, iridectomy being straight upward.

c—Drawn from life, eight months after operation. The scleral incision is seen under the conjunctiva just above cornea.—Jervey, page 131.

tion of the field is usually, although not invariably, found on the nasal side. It may be more marked above or below, depending upon the pressure upon the optic nerve. It is probable that the position of the physiologic cup, whether central or temporal, may determine in the beginning the character of the shrinking of the visual field. It is well to record in our histories, in routine examination of cases, a brief description of the position, size and depth of the physiologic cup for future reference and comparison.

With the continuance of the intra-ocular pressure the contraction of the visual fields proceeds until final blindness is reached. The color fields usually contract concentrically with the field for white, but atrophic processes in the optic nerve may alter this rule.

The blind part of the field, sooner or later, is found to be in contact with the blind spot of Mariotte as first pointed out by Bjerrum, and both relative and absolute paracentral scotomas of Seidel may be demonstrated merging with the blind spot of Mariotte.

To map out these defects one must use small objects of 1 mm. or 2 mm. on a Bjerrum screen or the excellent instrument devised by Dr. L. C. Peter, the campimeter. Lloyds' stereocampimeter, made by Bausch and Lomb, is even more useful in cases that have binocular single vision. The discovery of Bjerrum's sign and the scotomas of Seidel doubtless furnish valuable testimony in the diagnosis of early glaucoma, but, as has been said, it is a method of examination that must be accurately done to avoid error.

We must always hold to the central feature of glaucoma, increased intra-ocular pressure. Without increased pressure there could be no glaucoma; with it, all the manifestations of glaucoma may be present, depending upon the degree and the continuance of the pressure.

In simple glaucoma, the pressure may not be great, but it may be continuous. In some cases it may not be continuous, but may be intermittent.

The tonometer enables us to determine this with more accuracy than can be obtained with the fingers. Furthermore, a record of observations can be made so that comparisons can be made from time to time as to the condition of the pressure, which could not well be done with digital examinations.

In this lies one of its great values.

With any form of tonometer errors may arise from inaccuracy of technique, and with any of them, however carefully calibrated they may be on the basis of manometric measurements of normal intra-ocular pressure, there will be variations in results arising from such conditions as rigid or flaccid cornea, slight keratoconus, high astigmatism, regular or irregular, corneal scars, etc. Its value is a relative one. It may or may not give us an accurate reading of the intra-ocular pressure in terms of millimeters of mercury, but it will from day to day or week to week, if properly used, give us on the same patient the relation of impressibility of the eye to intra-ocular pressure.

In using the Schiötz instrument, the patient should be lying flat on the back, so that the face may be in the horizontal position. One per cent holocain or butyn solution is used to cause anesthesia of the cornea. The patient is asked to fix some object on the ceiling so that the instrument can be placed exactly vertical on the cornea, the foot plate occupying the exact center of the cornea. Failure to do this will give inaccurate readings. Two may work together to good advantage, one holding the instrument and keeping the patient's gaze in the right direction while the other makes the reading.

The instrument should be tested on the artificial metal cornea frequently, to be sure that the indicator arm registers accurately at zero on the scale. The instrument must be kept in perfect condition, so that the plunger glides easily.

Numerous observations seem to indicate that the normal limits of pressure seem to be between 15 mm. and 26 mm. on the Schiotz scale, but there may be individual cases where 28 mm. or even 30 mm. is normal.

Thesis on Etiology of Glaucoma and a New Operation. Every operation that has ever been devised for glaucoma simplex that has met with noteworthy success, has dealt with the relations of the iris base, the pectinate ligament and the canal of Schlemm. Furthermore, many failures, even where these relations have been properly disposed of, lie and have lain in the fault of not considering the possibility of relative blockage of the zonular filter and the absolute necessity of some means of decompression of the vitreous chamber.

With the desire to overcome these obstacles J. W. Jervey[5] has devised an operation which he describes as a "sclero-post-iridectomy." In the performance of this operation it must be borne in mind that the ciliary body diminishes materially in size through atrophy as a result of glaucomatous pressure until at length it forms scarcely any prominence at all. (Plate XII.) The atrophy affects the ciliary muscle as well as the processes. The recognition of this fact led to the idea of obtaining vitreous decompression through the zonula of Zinn.

The technique of the operation is as follows: A horizontal incision 8 mm. long is made in the conjunctiva about 6 mm. above the corneal limbus. The conjunctiva is undermined carefully to within a millimeter of the limbus, and the flap turned down over the cornea. At a point 2.5 mm. above the limbus, a Graefe cataract knife, with the flat of the blade held parallel

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(5) Southern Med. Jour., March, 1924.

to the limbus, is then boldly plunged through the ocular tunic and contents for a distance of say 12 mm. directly toward the axial center of the globe. (Plate XIII.) This carries the section through the sclera, the iris base, across the posterior chamber, through the zonule and into the vitreous structure. Possibly, but not necessarily, some of the ciliary processes are incised. On withdrawing the knife the incision is enlarged to about 3 mm. An iris spatula is now insinuated through the scleral opening and between the iris and sclera, and carefully thrust into the anterior chamber until its tip is easily seen in the chamber between iris and cornea. The spatula is gently but firmly moved from side to side, as far as the scleral opening will permit, thus freeing the adhesions existing between the iris and the inner sclero-corneal surface. An iris hook of special design is then passed through the scleral opening into the posterior chamber, between lens and iris, and engages the pupillary edge of the iris from behind. The iris is then drawn backward through the scleral wound and excised as in an ordinary iridectomy. The conjunctival flap is replaced and secured with one suture, or more is preferred. (Plate XIV.)

Several things are accomplished by this relatively simple maneuver. First, a sclerectomy is done, which may or may not be an item of importance. Next, free communication is established between anterior and posterior chambers; next, the loosening of iris adhesions and the posterior incision of the iris strips it from its adhesion over the ligamentum pectinatum, thus reopening the blocked drainage; and last, but not least, we produce vitreous decompression through the zonular fibres, allowing the vitreous aqueous to diffuse freely into the posterior and anterior chambers. The operation is designed to reduce tension and keep it reduced, not to cure glaucoma and restore vision. This distinction should be borne in mind.

Of the cases operated upon by this method, three eyes were simple glaucoma (of several months' or years' standing). Two were of the mild congestive type of the disease; and two were absolute glaucoma, following congestive attacks. Of the latter type of disease, with severe pain and excessive tension, there is little to say except that as a rule there is no operation short of enucleation that will provide permanent relief. Even of the two cases of absolute glaucoma, one with a painful tension of 85 mm., showed 12 mm., three weeks after operation, and then severe mental distress and domestic troubles and an attack of influenza supervened and two months after operation the tension had risen to 75 mm.; but even at that the patient was comfortable and free of pain. One year later tension was from 45 to 50 mm. and the patient continued comfortable and happy. The other one had a tension of 100 mm. just before operation. Three days later the tension was 35 mm.; but five weeks after that the tension had risen to 80 mm. with constant pain and the eye was enucleated. Macroscopic examination of the enucleated globe showed it so disorganized from an old previous panophthalmitis that nothing could have saved it.

Of the remaining five operations success may be fairly claimed for all. Tension before operation was 35 mm. and upward, 47 mm. and upward, and 55 mm., respectively, in the three of simple glaucoma. Two and three years, and eight months, respectively, after operation the tension in each was from 15 to 25 mm., one going recently to 30 mm. The two of mild congestive type could be fairly said to be arrested. One with a tension of 32 mm. at operation showed 25 mm. a little over two years after; and the other with a tension of 47 mm. showed 24 mm. fourteen months after operation.

As to vision and fields: Of the three eyes of the pure simple chronic variety the vision of the first before operation was 20/40 with about ⅛ normal field. Following operation the field enlarged, later contracted, and now (three years after operation) is again widening and is perhaps one-fourth to one-third smaller than before operation. The vision remains at 20/40. The second eye of this series, with vision of 20/29 before operation, remains unchanged after two years. The field before operation was about three-fourths normal, and its relative changes have been as in the first eye. The third eye of this series had a vision before operation of 20/20 minus, and what we might term a knot hole, or gun-barrel field of only five degrees around the entire periphery except at the horizontal temporal line, which went to seven degrees. Eight months after operation vision is 20/30 plus, and the field has extended to from five to twelve degrees, touching the five degree circle at only two points. The field is about doubled. (Plate XV.)

Of the two eyes of mild congestive type operated upon, one had vision of counting fingers at ten feet and a field one-fourth of normal. Twenty-six months after operation vision is 10/100 and the field is two-thirds normal. The other had vision of 20/200 before operation and a field one-half normal. Fourteen months after operation vision is 20/40 and the field is three-fourths normal.

Certain criticisms of this operation may be anticipated, such as: The possible inclusion of iris or ciliary tissue in the scleral wound; the possible injury to the ciliary body and to the lens; the danger of zonular rupture and extrusion of the viscid vitreous into the anterior chamber to further block drainage, will all be attacked as being more or less reprehensible and indefensible. Some great ophthalmologists have deliberately tried to include iris tissue in the wound for drainage, though this is not the object here. Herbert does it. Holth does it. Borthen has reported a high percentage of success with his operation of iridotasis, which is essentially iris inclusion. White, of Richmond, has reported successful operations by this method; and a few years ago Dunbar Roy, of Atlanta, and recently Wilder, of Chicago, reported a number of cases with happy results from this method. There are many others. Vitreous often flows into the anterior chamber following capsular operations, but it seldom if ever causes harm.

Again, there is no harm done by a clean wound of the ciliary processes if it should occur. Injury to the lens might happen in this operation, but it occasionally happens in nearly all operations for glaucoma. Here it will happen but seldom if the operator is dextrous and careful. Answering further objections, a small opening in the suspensory ligament is of no moment and very little if any of the viscid contents of the vitreous chamber will escape, while the watery element will freely flow into the anterior segment for drainage.

Technic of Iridectomy. R. G. Reese[6] describes the technic of iridectomy which he has followed in 237 operations on private patients, whose subsequent histories have been accurately followed for periods varying from four months to fifteen years. These patients have been repeatedly observed, and their fields, blind spots, tension and vision taken at practically every examination. Peters' and Lloyds' binocular campimeters and the tangent plane were used for recording Mariotte's blind spots, Rönne's step, and Seidl's and Bjerrum's scotomas. The tension was determined by digital palpation, and by Schiötz, Gradle-Hardy and McLean tonometers.

One hundred of these cases were tested by digital palpation, and two models of each of the above-mentioned tonometers. It was found that the Schiötz tonom-

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(6) Jour. Amer. Med. Ass'n., Feb. 23, 1924.

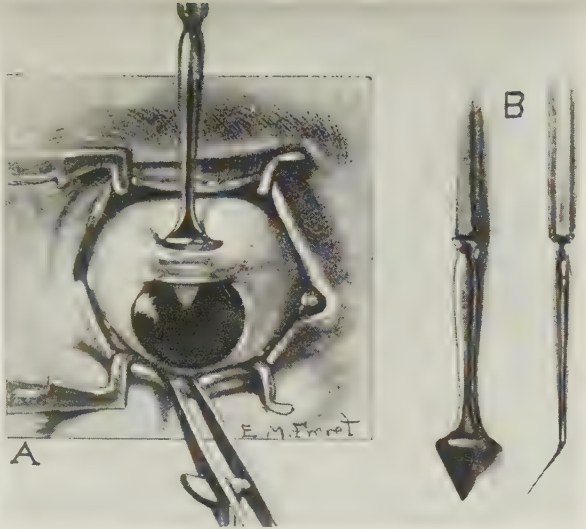
eter, was more accurate and easier to manipulate. The ages of the patients varied from 5 (not buphthalmos) to 87 years. There were sixty-five congestive and 172 noncongestive glaucomatous eyes operated on, and there was not a single instance of infection at the time of operation, or post-operative infection. Moreover, the author has never had an infection after an iridectomy done under a conjunctival flap. More than a thousand operations have been performed, as all iridectomies (preliminary, optical, etc.) are done by the method here shown.

After describing the preparation of the patient he thus outlines the steps of the operation.

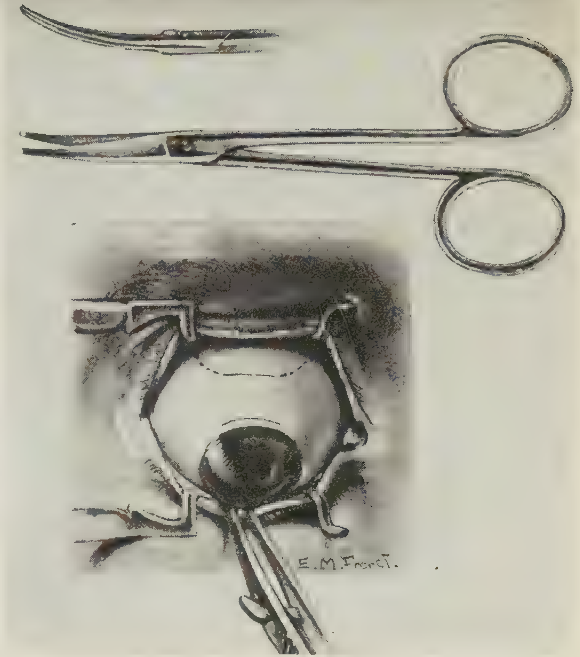
The patient looks up, and the conjunctiva and insertion of the inferior rectus, which is 6 mm. from the limbus, are firmly gripped with catch forceps. The patient is then instructed to look down, and the eye is so held. A special broad keratome, bent at an angle of 21 degrees, is used, and its point engages the conjunctiva 7 mm. from the limbus above, and is pushed forward to within 2 mm. of the corneal margin, where the sclera is penetrated obliquely, and the point of the instrument enters the chamber, anterior to the plane of the iris. (Plate XVI.)

The first thrust must not be made at right angles to the sclera so as to bend the point of the instrument, nor must a gimlet-like motion be used; but a straight and continuous push enables this triangular-bladed instrument to perform its work in a sawlike manner, as it is intended to do. The keratome is pushed slowly and continuously, the handle being turned slightly to the right, cutting mostly with the righthand side of the triangular blade, into the anterior chamber for the entire length of the blade, making an incision in the sclera that follows the curve of the limbus, and is the same distance (2 mm.) from it throughout and 8 mm. in length, thereby cutting the insertion of the pectinate ligament from the scleral spur and

PLATE XVI.

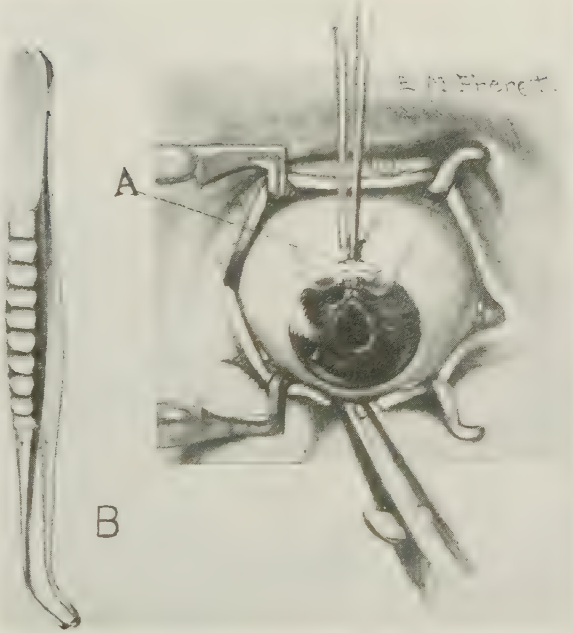


A—Conjunctiva pushed forward to scleral opening, and entrance of keratome in anterior chamber anterior to plane of iris. B—Broad keratome with rounded angles at base, and plane of cutting surface angulated at 21 degrees; blade is shorter and point less acute than usually used.—Reese, page 135.

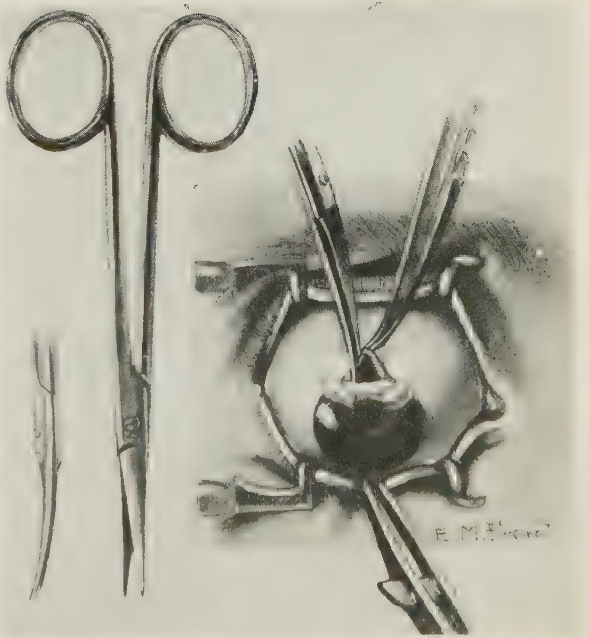


Curved blunt pointed conjunctival scissors: line of conjunctival incision 7 mm. from limbus above, and scleral incision 2 mm. above limbus.—Reese, page 135.

PLATE XVII.

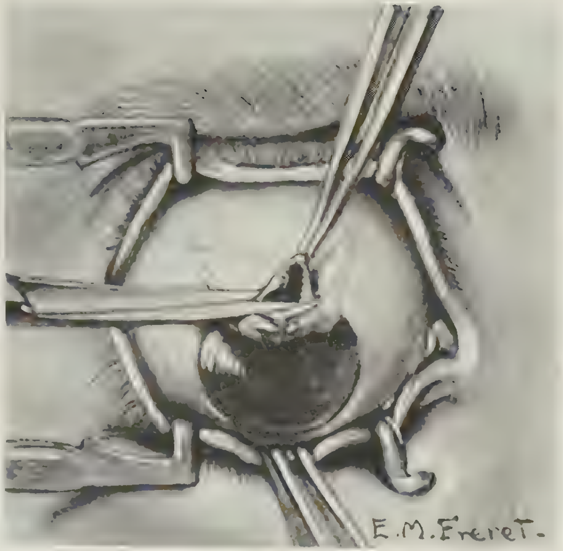


Entrance of forceps into anterior chamber, and manner of grasping the iris: A—Protruding anterior lip of scleral incision, which is either excised or punched out. B—Proper curve of iris forceps.—Reese, page 135.

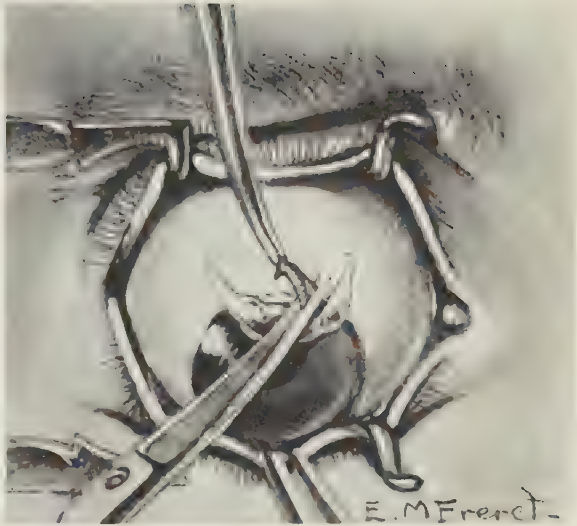


Curved, sharp pointed iris scissors, and first step in excising iris.—Reese, page 135.

PLATE XVIII.

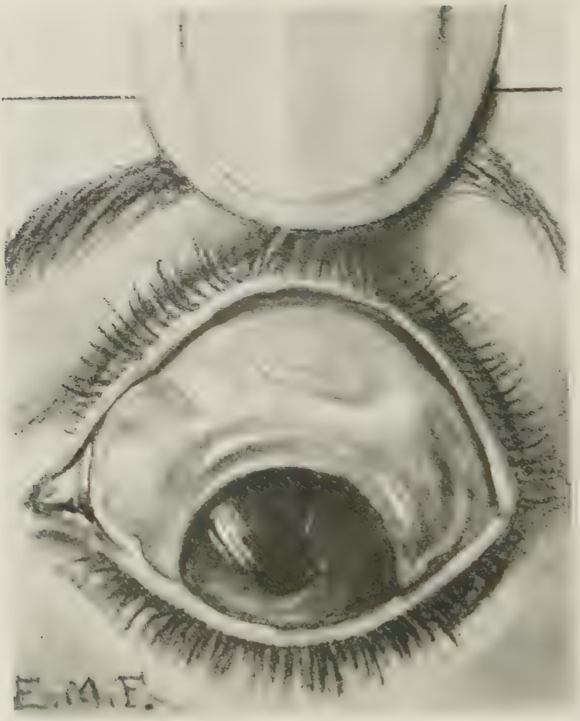


Second step in excising iris.—Reese, page 135.



Third step in excising iris.—Reese, page 135.

PLATE XIX.



An eye the fifth day after operation, just after massage, in which the conjunctiva is blebbed up by aqueous and limited only by adherent conjunctiva at original point of incision.—Reese, page 135.

opening Schlemm's canal for the entire length of the incision. As soon as this is accomplished, the keratone is quickly and smoothly withdrawn along exactly the same plane as that on which it entered. If this maneuver is rightly carried out, not a drop of aqueous will be lost. At the extremities of the conjunctival opening, which has now receded to its original position, 7 mm. from the limbus, a cut is made, curving upward and backward, with curved, blunt-pointed scissors, to allow the conjunctival flap to be displaced more easily and still not to interfere with the circumcorneal filtering space.

With the patient still looking downward, and the fixation forceps transferred to the assistant, the iris forceps are introduced into the chamber, which up to this moment is still full of aqueous; the points are allowed to open, and a firm grip (about 1 mm.) is taken of the sphincter muscle as close to the pupillary margin as possible, but not including it. The seized portion is drawn out through the scleral and conjunctival opening, so that the iris is everted, exposing its uveal layer.

The excision of the iris is done as follows. While the everted iris is gently drawn backward, and slightly to the left, with curved scissors, the concavity of the blades facing the right, a cut is made in the iris slightly to the right of the point of the forceps, downward and backward to the ciliary body. The iris is then drawn backward and to the left, and if the ciliary attachment has not been torn loose, a second cut is made, with the concavity of the scissors upward, and the blades are pressed firmly against the posterior portion of the split sclera, along the length of the incision. The iris is then drawn forward and slightly to the right and, with the scissors pressed against the sclera and the conjunctival flap displaced down over the cornea with a pledget of cotton, the third cut is made, making a coloboma, as in Plates XVII, XVIII, XIX.

The pillars of the coloboma are replaced and the anterior chamber irrigated, if necessary, with a warm salt solution one-half the strength of physiologic sodium chlorid solution. The conjunctival flap is stroked back in place, the eye irrigated with a warm saturated solution of boric acid, sterilized boric acid (petrolatum, 5 per cent.) applied freely to the lid margins, and a dressing of gauze and absorbent cotton held in place with isinglass plaster strips. This is applied to the operated eye only. A ring mask, with an aperture cut out in front of the unoperated eye, is applied, and no bandage is ever used.

If the case is one of noncongestive glaucoma, in order to make sure of a spongy, permeable cicatrix or fistulous opening, the piece of sclera which comprises the anterior lip of the scleral opening should be made accessible by depressing the conjunctival flap. The protruding anterior lip of the split sclera should be cut off with scissors, or pieces punched out of it with Stephenson's or Holth's punch forceps, making the edge serrated. Care is taken not to wound the conjunctival flap where it is adherent to this protruding lip of sclera, nor should the conjunctiva be dissected from it in order to get a better and larger surface; if this precaution is not taken, two raw surfaces will then be in apposition and will heal by primary union, secluding the scleral incision, and thus thwarting our purpose. It has never been found essential to punch or roughen the anterior lip of the scleral opening in congestive cases, and many of the chronic cases have been cured without it. However, in order to leave no stone unturned, the author has been following this routine in every noncongestive case for the last five years.

On occasion, it is necessary to irrigate the anterior chamber and free it from blood, and for this purpose a solution one-half the strength of physiologic sodium chlorid solution is used, as it has been noted that irrigation of the chamber with physiologic -sodium chlorid solution produces, in many instances, a wrinkling of Descemet's membrane, and some irritation.

After-treatment. The unoperated eye is cleansed daily, and 2 per cent. pilocarpin instilled for at least ten days. The patient is allowed to sit up the next morning after the operation, and the operated eye is inspected in twenty-four hours, when a 0.5 per cent. sterilized atropin solution is instilled, and used, according as circumstances require, thenceforth. The anterior chamber is restored by this time.

Gentle massage is done at the first dressing, and kept up daily for at least two weeks. The patient is discharged from the hospital in one week, the eye having been dressed daily with the same kind of dressing as heretofore applied. A 1 per cent. pilocarpin solution is instilled in the operated eye every night indefinitely, as a precautionary measure. Pilocarpin is instilled at night because it stimulates the action of the ciliary muscle, and aids the pump action during the hours when the muscle is inactive through sleep.

After massaging the eye, the entire circumcorneal conjunctiva has blebbed up by the escaping aqueous, infiltrating edema, and the author has known it to continue to do so after each daily massage for several weeks. In severing the pectinate ligament from the scleral spur for the entire length of the incision, a permanent opening is facilitated by the normal elasticity of the fibers of the ligament contracting in one direction, and the ciliary muscle pulling the scleral spur backward in the other direction. This would certainly have a tendency to keep this opening patulous, especially as it is assisted by the flow of the aqueous caused by the daily massage, which separates these surfaces.

The production of a permeable scleral cicatrix is enhanced also by the opening being protected with normal conjunctival tissue and not denuded tissue, as is the case in other conjunctival-flap operations. After the aqueous has filtered through the spongy cicatrix, or escaped through the fistulous opening, as the case may be, to diffuse under the conjunctiva, the only limit of this diffusion being the conjunctival opening 7 mm. above, which point alone could become adherent to the sclera. In other flap operations, two raw surfaces are in apposition, and they necessarily heal and limit the diffusion to a very small area, so that the aqueous that escapes through the vicarious opening can make its exit only through the small conjunctival covering of the cystoid cicatrix.

Posterior Scleral Puncture in Acute Glaucoma. E. Temple Smith[7] emphasizes the value of posterior scleral puncture in acute glaucoma. Priestly Smith held the view that in acute glaucoma the determining factor was an excess of pressure in the vitreous over that in the aqueous chamber: to put it crudely, there was a dropsy of the vitreous. Like most of the opinions of this great man—great alike in his breadth of view and in the incisive clearness of his logical mind—time has not withered nor custom staled its present-day value.

Whenever occasion offers, the author makes use of posterior puncture and always with immense satisfaction. But he realizes that the majority of ophthalmologists only vaguely know of it or are not very enthusiastic about it and some have raised the bogey of retinal detachment as a result of such a puncture. Now a fairly long experience has satisfied the author that such a result does not occur; any more than it occurs after the much larger incision required for the magnet-removal of foreign bodies from the vitreous chamber by the posterior route. Neither does choriodal hemorrhage occur. To be able to relieve immediately the most intense pain; to convert an urgent, necessary

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(7) Med. Jour. Australia, Apr. 12, 1924.

operation from being perhaps the most pregnant in possibility of disaster in the realms of surgery, into a safe, easy and deliberate one, is no small matter. Posterior puncture will do all this.

The responsibility of operating on a one-eyed man with acute glaucoma is enormous. But by relieving the strangulated circulation and thereby removing the acute symptoms of glaucoma, it is possible to postpone operation until the eye is quiet enough for trephining or, failing that, iridectomy can be done without undue risk.

It is strange why this procedure is not more emphasized by teachers and in text-books. It has stood the test of time and is analogous to a herniotomy in strangulated hernia. There is no reason why it should not be done by the practitioner in the country, provided that he can diagnose acute glaucoma, has seen it done once and possesses a Graefe knife with a virgin point. It certainly should be done as a routine measure by the ophthalmic surgeon.

The Mechanism in the Production of Increased Tension in Hydrophthalmos. The condition was described as early as 1722 by Saint-Yves, but it was not until 1867 that its glaucomatous nature was recognized by Mauthner. Among the various causative factors adduced may be mentioned the nervous secretory theory of Donders, interference with the outflow through the venae vorticosae, primary uveitis, choroiditis, serous iritis and, finally, obliteration of the filtration angle. This last theory seems to meet modern requirements and may again be divided into three types.

Treacher Collins and his followers hold that there is an imperfect separation of the iris from the cornea, whereby the avenue of escape through the canal of Schlemm is closed.

Romer, Gross, Reis and Zentmayer cite cases in which there was an absence, in whole or in part, of the canal of Schlemm, and believe this to be the chief factor in producing the increased tension.

Weeks, Mayou, and others have observed cases with anterior and posterior synechia following inflammatory lesions, but these should be classified under the head of secondary glaucoma of infants rather than hydrophthalmos.

The sections here illustrated and described by C. A. Clapp[8], were obtained from an infant born in the maternity ward of the Johns Hopkins Hospital by breech delivery without external injury. (Plate XX.)

The eyes were seen on the day after delivery. The condition was diagnosed as one of congenital hydrophthalmos. Both eyes protruded, the measurements being, respectively, 17 mm. for the right, and 18 mm. for the left with the exophthalmometer, the average for infants of this age being 10 mm. The corneæ were enlarged, the horizontal diameter of the right being 13 mm. and of the left 14 mm., whereas the average for the normal infant is 8 mm.

Both corneæ were decidedly steamy and opaque especially in a horizontal band, the right being so cloudy that the pupil could not be seen, and the left pupil only with difficulty. Both anterior chambers were deep and there was slight circumcorneal injection. The tension as estimated by the fingers was 50/60 mm. Hg. The fundi could not be seen. The child lost weight for 7 days, then started to gain, but died on the tenth day.

Autopsy showed a fairly well formed skull, which, however, on being opened, showed the cavity filled almost entirely with a chocolate-colored fluid, the brain being reduced to a small nodule 4x3x2 cm.

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(8) Johns Hopkins Hosp. Bull., March, 1924.

Microscopical Examination. The *corneal epithelium* is of nearly normal appearance at the periphery, consisting of from five to eight layers of cells and in general having well stained nuclei. As one approaches the center of the cornea, the thickness of the epithelial layer varies, and the nuclei seem gradually to undergo degeneration, their places being taken by vacuoles so that near the center of the cornea only a few nuclei are seen, and even the protoplasm assumes a granular appearance. The surface of the epithelium is wavy and irregular, this being more pronounced over the central portion where the degeneration is most marked. The area of greatest irregularity of surface, and degeneration of the cells, corresponds to the portion which, clinically, appeared steamy and cloudy. (Plate XXI.)

The *substantia propria* is of normal thickness around the periphery, but shows a very decided thinning just above the center of the cornea. The endothelial cells upon the inner surface of the cornea are thinned and elongated, and Descemet's membrane is thrown, more or less, into waves.

The *ciliary bodies* appear as small, atrophic masses, the inner portion consisting of ciliary processes, long and finger-like, with an outer layer of epithelial cells, immediately beneath which is a dense layer of pigment. The central portions of the processes are composed of loose connective-tissue cells. (Plate XXI.)

The *iris* is very much atrophied and thinned, the outer portion consisting of hardly more than a well marked pigment layer on the posterior surface, with a few stroma cells and blood vessels, the pupillary margin being considerably thicker and showing a few muscle cells.

The filtration angle. The angle between the cornea and the base of the iris varies considerably in the different sections, some showing an extension back to the filtration spaces, although never back of them, as occurs in normal eyes, while in other sections there is a very decided incomplete separation at this point, which would confirm the theory advanced by Treacher Collins of an incomplete separation of iris from cornea or a prenatal condition of the ligamentum pectinatum. This is shown very conclusively in some sections in which the iris is seen to be adherent to the cornea for some distance in front of the atrophic ciliary body. The separation of the iris from the cornea, it may be remarked, is more complete in the normal fœtal eye at six months.

The *retina* is practically normal.

The *choroid* is thin, and its spaces are filled with red blood cells. Very few pigment cells are found in the choroid, although the pigment layer of the retina is well marked.

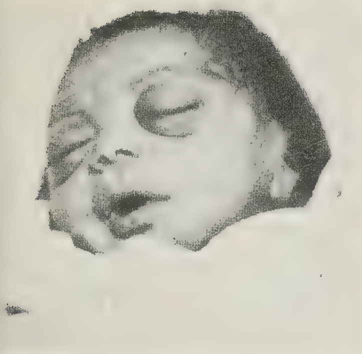
The *optic nerve* shows very curious changes. There is some cupping but it is not pronounced. (Plate XXII.)

The *cribriform membrane* is made up of loose connective-tissue cells, below which is seen a distorted optic nerve, made up largely of thin-walled blood vessels, with a large number of neuroglia cells and a few axis cylinders. (Plate XXII.)

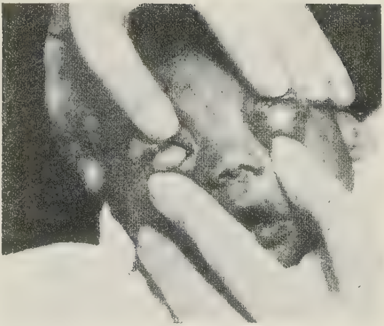
After careful study of these sections, it seems probable that the condition in this case resulted from an incomplete separation of the cornea from the iris, rather than an absence of the canal of Schlemm. The peculiar degenerative changes in the optic nerve are probably due not to the increased tension but to the anencephalia.

Although the claim of heredity has been made as an etiological factor, no evidence has been obtained that such was the case in this instance, although the family history was very unsatisfactory. As regards the nomenclature for these cases, it would seem better that the term hydrophthalmos or buphthalmos should be reserved for those cases of increased tension and general enlargement of the eye resulting from a congenital defect and that those due to injury or an

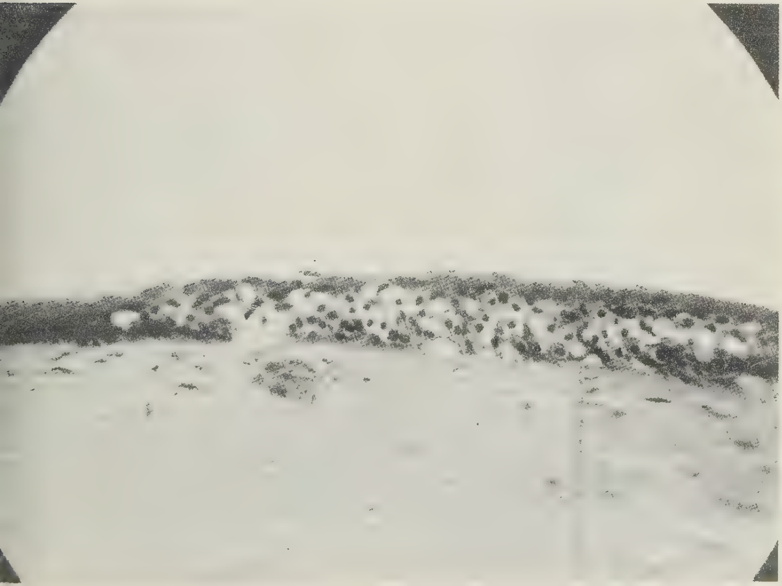
PLATE XX.



Showing protrusion of lids as result of enlargement of eyeballs.—Clapp, page 141.

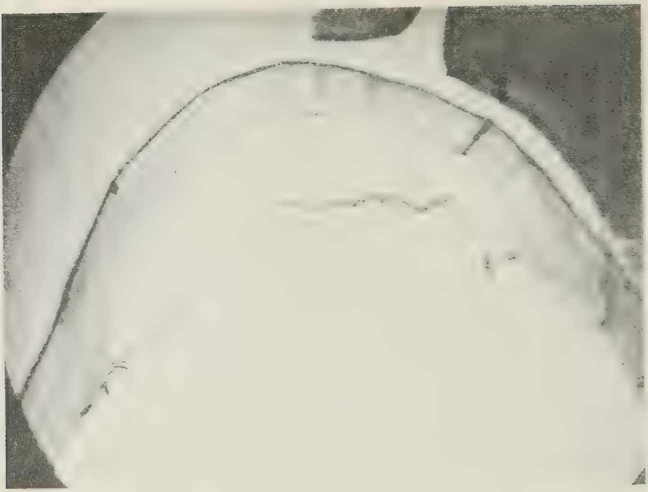


Lids separated, showing cornea with ground glass appearance.—Clapp, page 141.

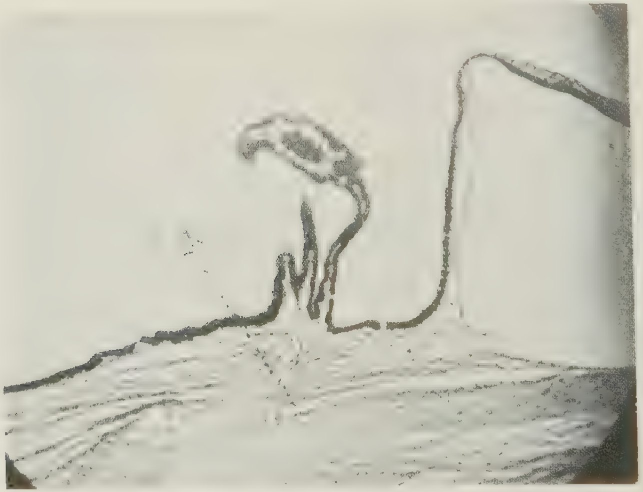


Corneal epithelium under high power, showing presence of vacuoles.—Clapp, page 141.

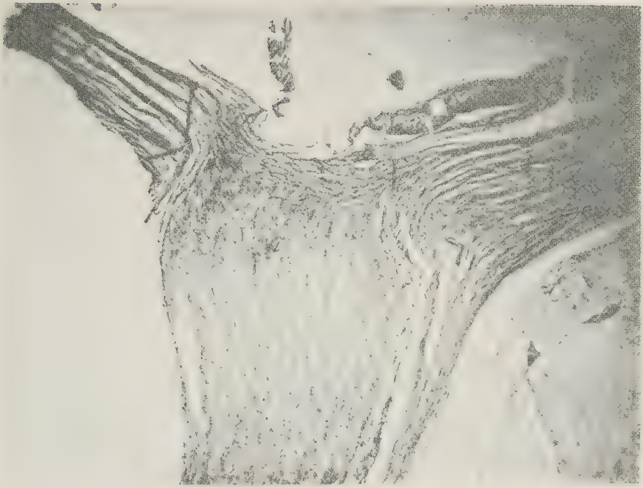
PLATE XXI.



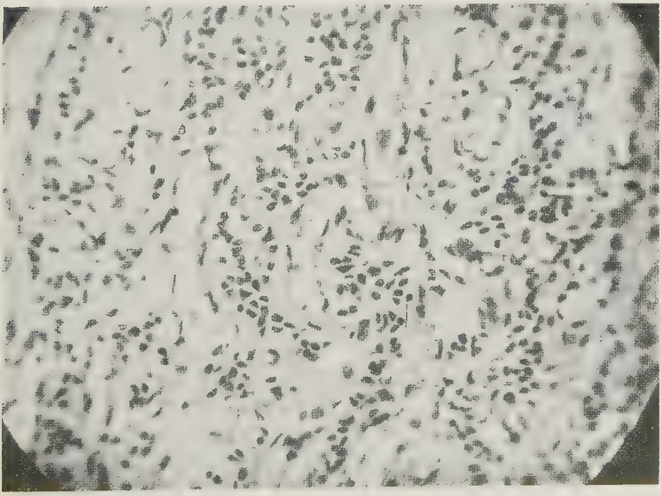
Cornea thinned just at the juncture of the upper and lower lids.—Clapp, page 141.



Atropic condition of the ciliary body and iris, canal of Schlemm behind the iris angle.—Clapp, page 141.



Cupping of optic nerve as seen under low power.—Clapp, page 141.



High power appearance of optic nerve, showing large vascular spaces with distorted optic nerve fibers.—Clapp, page 141.

inflammatory process should be put under "Secondary Glaucoma of Childhood," inasmuch as both clinically and pathologically the conditions are quite distinct, and the present method of classifying all as hydrophthalmos or buphthalmos is very confusing and unscientific.

THE VITREOUS.

Hyalitis of Indeterminate Etiology. Complete or partial loss of transparency of the vitreous humor is among the most serious conditions that the ophthalmologist is called upon to treat. At present there is not complete agreement on the anatomic structure of the vitreous body. There are two views: The older one being that it is a semi-gelatinous structureless mass; while the later view is that it is a gelatinous substance, the center core being fluid or nearly so with a definite lamellated structure and a limiting membrane.

Benson in 1894 called the profession's attention to a form that he named monocular asteroid hyalitis. Examined by the ophthalmoscope the vitreous was perfectly transparent but woven all through it, in their various forms and shapes resembling the starry heavens, were innumerable smooth, fixed spheres of a light cream color. In the case cited by Benson the acuity of vision of the affected eye, when compared with the patient's other eye, was as good as the latter. The eye, however, could maintain a sustained effort only for a short interval. Argyll Robertson, of pupillary fame, presiding at the meeting when Benson reported his case, said that he had an exactly similar case except that the vitreous opacities were freely movable. Neither of these eminent ophthalmologists had any idea of the nature of these bodies. In 1921, Verhoeff studied thirteen cases of asteroid hyalitis in his own thorough and complete way, and established to his satisfaction that these bodies were not an excretion from other tissues but were primarily formed in the vitreous as calcium soap mixed with insoluble compounds of cholesterol and lecithin. Verhoeff believes that the condition requisite for the development of asteroid hyalitis is intra-ocular angiosclerosis combined with an altered condition of the blood.

Another type of hyalitis characterized by dust-like opacities were investigated by Straub. He clearly demonstrated that these were leucocytes in the vitreous as were the deposits on Decemet's membrane in cyclitis. Straub injected the vitreous with pathogenic bacteria. These attracted leucocytes from the vessels of the ciliary body, the choroid and retina. There was no increase in the white cells of the latter. Then he injected the ciliary body when he found on sectioning the eye that there were no white cells in the vitreous but that lymph and corpuscles filled the vessels of the ciliary body itself. The deduction from these studies is that the infective material changed the cell reactions of the vitreous body making them chemotaxic to the white corpuscles of the blood, and acted in a similar way on the ciliary body, choroid and retina. When Straub infected the ciliary body with T. B. bacilli and produced a granuloma, there were but few white cells in the vitreous, but there was a slight swelling of the optic nerve and the nerve cup was filled with leucocytes. This observation may be of much practical value, for in cyclitis a slight haziness of the optic nerve and swelling of the immediately adjacent retina is said to be nearly always present. These tissues are sensitized by the toxins of the cyclitis and become chemotaxic to leucocytes.

Synchysis scintillans has also been long recognized, although the mechanism of its production admits of various hypotheses. The most accepted of these is that cholesterin crystals are present in a fluid vitreous. When the eye is moved the light reflected from the moving crystals resembles a shower of shining particles. Just how the cholesterin is deposited in the vitreous and where the crystals are actually formed—within or without the globe—awaits further investigation.

There is another type of hyalitis, which is quite common. It varies from the faintest haziness of the vitreous to absolute opaqueness. With the aid of most skilful laboratory technicians and commanding the most complete laboratory facilities and equipment, J. J. O'Brien[9] has been unable to determine the cause of the hyalitis in the cases which he here describes. There was no injury in any of the eyes, and cyclitis, uveitis, iritis, choroiditis, retinitis, syphilis, tuberculosis, portal congestion and anemia were ruled out. In one of the cases there was, and had been for ten years, an extensive skin lesion. This had become so much a part of the patient's existence that she did not even mention it till discovered by the nurse. Whatever, if any, casual relation there may have existed between the dyscrasia from which the skin lesion followed, and the hyalitis must remain pure conjecture.

A female, age 60, had always been in poor health. Early in the fall of 1922, her vision gradually dropped until she could neither read nor sew and the outdoors took on a smoky look. Her vision uncorrected was:

R. 20/50-1 J. 18
L. 20/100 J. 0

Examination of the right eye showed a slight conjunctivitis, and position and movements of the globe normal. The cornea and media were clear, the pupil

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(9) New York State Jour. Med., Mar. 7, 1924.

reacted to light and accommodation, the anterior chamber was normal in depth, the iris was a good color and free from new blood vessels, atrophy or increased connective tissue, the lens was transparent, the vitreous was somewhat hazy but free from opacities. The vessels, disc and retina were seen with a fair degree of clearness. They were apparently normal. The anterior segment of the left eye was the same as the right but the vitreous was so hazy that a good retinal reflex was all one could see. Under vigorous treatment the vitreous cleared sufficiently to make examination of the retina, disc and vessels fairly satisfactory. They were similar to those of the right eye. This improvement was, however, not permanent; the haziness reappeared and the vision again dropped. There was no improvement from subsequent treatment. Her teeth had been extracted, one or two at a sitting, many years ago; so apical abscesses and pyorrhea were eliminated. The blood and spinal fluid Wassermann were negative. A searching examination of the blood and urine disclosed nothing abnormal. Transillumination and *x*-ray of the sinuses were normal, as were the nares and pharynx. Examination of the nasal sinuses, at frequent intervals over a period of months, revealed no pus. Repeated refractions failed to improve the vision. It remained, as did the condition of the eyes, permanent; and the factor or factors underlying it has baffled our united efforts to unravel them.

A male, 69 years old, noticed in April, 1922, that his vision seemed dim, and that he could see better on dull than on clear days. His eyes had never been injured and at no time had they been inflamed. They were never red nor did he have the slightest discomfort in them. On September 5, 1922, his vision uncorrected was:

R. 10/200 J. 0
L. 10/200 J. 0

Examination of the blood, spinal fluid and urine showed nothing abnormal. *X*-rays of the teeth and sinuses were normal. Close observation of the nasal sinuses at numerous examinations threw no light on the condition. There was no tonsillar tissue present and his general health and personal habits were exceptionally good. Examination of the right eye showed that the cornea was clear, media slightly hazy, the pupil active, the disc a solid white, physiological cup and lamina cribosa with increased connective tissue in the disc. The arteries were moderately sclerotic and the fundus was apparently normal. Examination of the left eye showed it to be the same as the right eye. Vision corrected was:

R.+2.00 sp. =20/200
L.+2.00 sp. ( ) + 0.50 cy. ax. 0.90=20/100

A month later the vision had dropped to 20/200 in each eye. This was his poorest vision, for by the end of November the vision had gradually risen with correcting spheres to 20/30. There has been a steady improvement for by February, 1923, the uncorrected vision was:

R. 20/200
L. 20/200
corrected by
R. +2.25 sp.=20/20—3
L. +2.25 sp.=20/30—4
add +3.50 sp.=J.3 for each eye.

The near vision, it appears, is not so good as we usually get with this distant vision, for it is not uncommon in ordinary cases to get with this vision J. 1.

The high points of this case are:

1. The marked loss of vision.
2. Its further drop under the treatment that brought about the excellent recovery.
3. Failure of the laboratory to discover any abnormality in the blood, spinal fluid or urine.

4. Failure to find a focus of infection in the mouth, nasal sinuses, nasopharynx or tonsils.

5. Failure of a careful examination by a very competent internist to find any disease in any organ.

On June 19, 1922, a woman, age 53, gave a history of being ill for the past three weeks with pleurisy. At that time she complained on and off of pain in her right forehead and adjacent temple. When this pain subsided, her right eye reddened. The eye had been annoying her for the previous three weeks, and at times she had had a feeling of discomfort in her left eye. The patient was a short, stocky, vigorous woman who had always enjoyed good health, except for psoriasis of more than ten years duration. The pain, discomfort and redness of her eyes were not periodic but came and went at any time. Examination of the right eye showed the conjunctiva quite red with no pericorneal congestion or tenderness. The cornea and media were clear; the anterior chamber slightly shallow; the iris of a good color, and reacting promptly to light and accommodation. The disc, vessels and fundus were normal. There was a slight flushing of the conjunctiva of the left eye that was bleached white with adrenalin. In all other respects the eye was normal.

The vision was: R. 20/50
L. 20/20-2
The tension was: R. 27
L. 30

Eleven days later there was but little discomfort in the right and none in the left eye. The latter was white but some redness remained in the right. On July 13 she had some pain in right brow and adjacent temple; and a little while later it moved into the right eye. The right eye became again intensely red, but there was no change in the tension, vision, pupil, media, vessels or fundus. Three days later there was again marked improvement, and the fields for white, red and green were normal. The condition steadily improved and the eye felt and functioned as well as ever. But on August 10, the old pain in the old way and in the old place returned and the eye again became red. There was injection of the scleral vessels and the lids were edematous. There was no change in the anterior chamber nor iris, but the retinal reflex was lost and the vision was light perception. The acute symptoms gradually subsided but with no improvement in vision. She retired on the night of August 24, feeling fine. When she awoke next morning she could barely see light, and when seen the same forenoon the left eye was similar to what the right had been at the time its vision was lost. She was thoroughly examined by two internists who found nothing abnormal. One of these had been her attending physician for ten years. All the tests known to a modern laboratory were invoked but added nothing to the knowledge of the etiology. The hemoglobin, leucocyte count, red blood count, color index, differential count, Wassermann, blood sugar, blood culture, urea nitrogen, uric acid, nonprotein and creatinine were all within normal limits. As before stated, she had had, however, for at least the past ten years psoriasis covering nearly all her body, exclusive of her head and face. It is not probable that they had any relation to her eye condition for the latter was recent, the former an old story. At this time the patient became more or less irrational and had to be restrained. On September 1, she was quiet and considerable vision had returned to her left eye, for she could see the dresser, the mirror and the flowers on it. Her condition was unchanged until September 3, when at noon she lapsed into unconsciousness and two hours later passed away.

In attempting to explain the loss of transparency of the vitreous, it may have been brought about in this way: owing to the failure of one or more organs to function properly, or to an occult focus of infection, a poison is retained that ought to be neutralized or excreted. In some unknown way the vitreous becomes sensitized to this poison and is chemotaxic to it. From this follow all the phenomena narrated with the now slow and again rapid clouding of the vitreous. That a chemical change takes place in the vitreous of the affected eye follows, for only one eye may be attacked while the poison has equally ready access to the other. So it seems as if there were as least two factors in these cases of loss of transparency of the vitreous.

First: A protoplasmic poison of unknown origin and identity is in the general circulation.

Second: In an unknown manner the vitreous is so altered that it attracts this poison and becomes chemotaxic to it with loss of its transparency. The problem, then, is to determine these factors accurately. He who solves them will be of incalculable aid in treating disturbances, not only of the vitreous, but of all the tissues of the eye, and may be of inestimable help to a clearer conception of disease in general and eye diseases in particular.

THE OCULAR MUSCLES.

The Surgical Treatment of Concomitant Squint. The eyes may be straightened by tenotomy, by tendon tucking, and by resection with or without advancement. The treatment depends somewhat on the type of squint and whether or not the deviating eye is amblyopic. If the eye is hopelessly amblyopic, only a cosmetic operation is indicated and the surgery may be confined to one eye. In such cases Peters[1] does a resection with

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(1) Atlantic Med. Jour., February, 1924.

advancement, depending on the angle of the squint. If this is not sufficient, a tenotomy of the opposing muscle in the same eye is warranted.

If vision is equally good in both eyes and fusion is fair or good, the same amount of surgery should be done on both eyes and the operation should consist in resection with or without advancement, never tenotomy. The same treatment is indicated in cases of alternating convergent squint.

In divergent squint, tenotomy is of more value and should be associated with resection and advancement whether one eye is amblyopic or not.

Immediately after the removal of the bandages, fusion training should be instituted providing the amblyopia is not too marked.

With regard to the non-surgical management of squint, Peters,[2] for purposes of treatment groups the cases into: (1) its unilateral convergent type; (2) the true alternating convergent squint; (3) divergent squint.

1. *Unilateral Convergent Squint.* Although an objection has been raised by some to speak of a squint as unilateral, the peculiar characteristic of this form of strabismus to become manifest in one eye, while the other eye habitually fixes, justifies the term as descriptive of the type.

The first step in the management of this form of squint, a procedure which is common to all forms, is to determine the status of the refraction. It would seem as though it is almost superfluous to discuss the type of cycloplegic which should be employed for this purpose. Unfortunately, it is only too true that a limited number of advocates of homatropine carry their enthusiasm so far as to employ this drug even in children. Regardless of the advisability of its use in adult life, a matter for more than academic discussion, it is our conviction that it should never be employed in the refraction of children. The most satisfactory drug for this time of life is atropine sulphate. A half per cent., or even a one per cent. solution, should be instilled three times daily for two days before the measurements are taken. Retinoscopy should at all times be practiced at sittings sufficiently numerous to make correct measurements. While the complete spheric error in hyperopia should be carefully estimated, the cylindric defect is equally important.

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(2) Jour. Tenn. State Med. Ass'n., May, 1924.

In the prescribing of glasses three questions confront us. First, how low an error should be corrected; second, how much of the error should be corrected; and third, how early in life should glasses be prescribed. To the first question, our answer is, on general principles, an error of one diopter of hyperopia with a half diopter of astigmatism, should be considered as of sufficient importance to correct. This is especially true of children of school age. Younger children may be spared the annoyance of wearing glasses of a correction lower than this until such time as they must attend school.

The second question is easily answered. A full sphero-cylindrical correction should be prescribed in myopia. The same applies to hyperopia, with the subtraction of a quarter or half diopter in moderate degrees, and a little larger subtraction in very high degrees, if the full correction is not well borne at first.

The age when glasses should be prescribed depends upon the refractive error, and the state of the fusion faculty. The latter in very young children can only be surmised. It is well known that true alernating strabismus appears at an earlier age than unilateral squint. Most instances of the former occur before the end of the second year, while unilateral squint may not appear until the fourth year or even later. As the fusion faculty, as a rule, is totally absent or very defective in alternating squint, it is likely that this type of squint, which appears early, follows as a result of a very defective fusion faculty. This condition can not be overcome by training until the child reaches the age or three or three and a half years. The refractive error, therefore, becomes the main consideration. If the error is three diopters or more, the average child will tolerate glasses without protest as early as sixteen months. Two purposes are accomplished. Vision, with the aid of the occlusive bandage, is preserved, and the angle of deviation may diminish. In some instances the eyes become straight.

In young children, under three, the second step in the management of squint is the institution of measures to preserve central vision, or the correction of amblyopia if it is present. In infants, when the prescribing of glasses is impracticable, this becomes the first step in treatment. Two methods are practiced. Either mydriasis is maintained in the fixing eye or an occlusive bandage is worn over this eye. The use of an occlusive bandage is the better method. Atropine does not entirely prevent the use of the eye and the fixing eye may continue to fix in spite of the drops. In young children, on whom it is difficult to retain a bandage, the drops may of necessity be resorted to. Worth has very correctly pointed out that young children are susceptible to either method, and care, therefore, should be observed that neither method is employed too long, lest the amblyopia be transferred to the other eye. If drops are used, a daily instillation of a weak atropine solution is made in the fixing eye for a period of one week. This should be followed by a period of rest for several days after the pupil has returned to the normal size. The routine should be repeated until the desired results are obtained. If the squint has been transferred it may be necessary, for a brief period, to use the atropine in the formerly squinting eye. During all the treatment, the case should be under observation at least once a month.

The occlusive bandage is best adapted for children three years of age or older. As a means of correcting amblyopia in children up to six or seven years of age, and of improving the vision in older children, when complete restoration in sight is impossible, the method is of great value. It is also of great help in older children, before operation, when the squinting eye has lost its power of fixation. A celluloid clip placed on the glass is unsatisfactory and accomplishes little but inconvenience to the child. The bandage should be so applied that it will be impossible for the child to see with the occluded eye. If the bandage is worn to prevent amblyopia, its application for two or three hours daily will suffice. This, however, must be determined by regular tests. For these tests, Reber's test chart is most satisfactory for children as young as two years. For amblyopia well established, the bandage should be worn for at least half the day during which the child is awake. After the child has grown accustomed to the bandage, part of the school work should be performed with the squinting eye. The use of the eye at close range is more valuable than use at distance in bringing back vision. Writing, copying and reading are excellent training, and the progress is more rapid and satisfactory when this form of exercise is indulged in with the bandage applied.

The third step is fusion training. At the earliest possible age, the state of the fusion faculty should be determined. For this purpose, the Worth-Black amblyoscope is used. Children of three are apt subjects for the determination of Worth's first and second classification of the fusion state. First, does the child have simultaneous macular perception? A mouse and a trap, for example, are placed in the amblyoscope. If the child can see both when the tubes are placed at the approximately proper angle for his degree of squint, he has simultaneous macular perception. If he can place the mouse in the trap, the evidence of simultaneous macular perception is stronger. His inability to do so, however, may be the result of mechanical causes, as for example, the improper angle of the fusion tubes and the inability of the child properly to co-ordinate the tubes because of his tender years. This should be confirmed by varying the objects to exclude error. Second, does he have fusion without the sense of depth? If the child knows the alphabet, an "F" before one eye and an "L" before the other is the most practical test. He may see the two letters simultaneously, but if he can make an "E" out of them, he has fusion. Other similar tests can be used, as for example, a man, in which parts of the man appear before both eyes to aid fusion, but only the complete figure can be seen in fusion. Unless this second stage of the fusion test can be obtained, there can be no assurance that the child has a fusion faculty. If the child possesses this faculty only in part, there is hope of developing a fusion faculty which will answer the third test.

The third test for fusion involves a sense of depth or relief. For this purpose, Mr. Berry's addition to the stereoscope is adapted to the amblyoscope. Two large circles of equal size, to aid fusion, have smaller circles placed to the outer or inner sides. If the small circles are to the outer sides, the appearance to a normal fusion faculty will be that of depth, and the child will see a bucket standing on its bottom. If the small circles are to the inside, the sensation will be that of relief and the illusion will be that of a bucket upside down. This test can be varied by elaboration into baskets and other objects involving the same principle. It is easy of demonstration and offers the surest prognosis of the ultimate outcome of the case.

Having determined the state of the fusion faculty, two propositions present themselves for solution. First, given any one of these three possibilities, simultaneous macular perception, fusion without a sense of depth, and true fusion with a sense of depth or relief, what bearing does each have on the general outcome of the squint? Second, what can be done to improve and develop a fair but imperfect fusion faculty?

Simultaneous macular perception without any evidence of fusion does not offer much hope of improvement in the squint unless there is present at the same time a high hyperopic error. If this is present, any improvement which may follow must be attributed to the correction of the refractive error. This type of case can rarely escape operation. If fusion is present without a sense of depth, the prospect of restoring parallelism by proper training is fair. The results will depend, in a measure, upon the presence or absence of amblyopia and partly upon the correction of a high refractive error. Fusion with a sense of depth, even though imperfectly developed, offers a good basis for treatment and success without operative treatment in a large proportion of cases. Amblyopia of a high degree and a wide angle of squint are the two barriers which usually presage failure. This in part answers the second question, what can be done to improve and develop an imperfect fusion faculty? If one receives the co-operation of the patient, the only obstacle in the way of developing fusion is amblyopia. If vision is good in both eyes, a majority of the cases which fall into this group can be treated successfully without an operation.

In the discussion of the second step of the treatment of squint, it is evident that amblyopia looms up as a barrier with which we must reckon. Its prevention and measures to correct it if present are again impressed upon us.

If these three methods are faithfully practiced, what are the prospects of avoiding operation? If a high degree of amblyopia is present and can not be improved, it furnishes an impassible barrier which usually means that an operation must be resorted to to restore parallelism. If amblyopia is not present and the angle of squint is not too great, the chances for a complete recovery are excellent. In order to appreciate the influence of the angle of squint, it is well to recall that fusion can not take place if the images are too far apart. It is true that by means of the amblyoscope, the images may be brought closer together by gradually reducing the angle of the tubes. In squint, however, of more than twenty to twenty-five degrees, this is rarely possible and operation must be performed to bring the visual axes within reach of fusion. A wide angle of deviation, however, should not prevent one from following the course outlined, because these measures are essential to make the operation a successful cure instead of a cosmetic operation which is so often practiced.

2. *True Alternating Convergent Squint.* In this group of cases, the refractive error is usually negligible or so slight as not to be counted on as a factor either in the development of the squint or its treatment. The important factor, however, is a totally absent or very defective fusion faculty. In few of these cases can one find more than simultaneous macular perception. It necessarily follows that the two methods of treatment which are of most value in training can not be successfully employed. If fusion tests show an absent fusion faculty, fusion training may at once be abandoned and the same may be said of refraction. If the first examination shows a low refractive error, glasses should be omitted until the child is of school age, when they may be prescribed according to the rules which are so well known. Until the child is about six years of age, the only treatment which can be given is that to prevent amblyopia and the correction of the same if it has appeared.

At the age of six years operation should be employed to restore parallelism—an operation which can only be performed for cosmetic purposes. The operation may be undertaken a year or two earlier in well developed children, if it is possible to correct the entire deviation by a single advancement with resection. It is not a good procedure to operate on both eyes at so early an age.

3. *Divergent Squint.* This group of cases might well be included in the second. They differ, however, in two particulars, namely, in that they develop as a rule much later than the convergent squint, and in that the fusion faculty as a rule is present although not fully developed. The refractive error is hyperopic almost as often as myopic. The error in either case is higher as a rule than in the true alternating convergent type. Refraction, therefore, is important but can not be counted of great value in correcting the divergence. Fusion training is necessary in the interests of paving the way for a successful operation, rather than to prevent the operation, which it rarely does. Treatment by means of an occlusive bandage is also important, although amblopia is much rarer in divergent squint than in convergent. One would naturally conclude that non-surgical measures do not offer a very great deal. This is correct, if they be regarded as measures which will prevent operation. This is, however, not a good reaon for allowing the child to drift without treatment until of such age as might be called operable. All these measures should be rigidly practiced in order to convert a cosmetic operation into one which may be called curative. Some years ago the Greens, in a very well written paper, expressed the thought that operation should be instituted early. The best age is about six. There is no good reason why it should be postponed when an operation becomes necessary. There is nothing to gain and much to lose by postponement. Proper treatment before and after operation should result in a

large percentage of cures. Amblyopia is the crux of the situation in most instances. This can be avoided in a majority of cases.

Finally, after operation, non-surgical measures are of greatest importance. At this stage of the treatment, the amblyoscope is replaced by the stereoscope. The operative interference should be so precisely performed that the images of the two eyes are brought close enough for fusion training by means of the stereoscope. A half hour's practice daily with this instrument will be a wonderful aid in bringing about single binocular vision if the amblyopia is not insurmountable. This instrument demands greater respect than is usually accorded to it. It acts as a stabilizer and improves the muscular co-ordination necessary for the correct execution of innervational impulses. It is especially valuable in esophoria and in the post-operative treatment of squint.

Spasmodic Diplopia. Double vision, either transitory or constant, is a fairly common symptom in the practice of ophthalmology and neurology. During the last five years, the literature of epidemic encephalitis has so emphasized diplopia as being a symptom of diagnostic importance that perhaps one is apt to regard it, in certain types of obscure cases, as evidence of encephalitis.

Constant diplopia is not so difficult to account for in a given patient. G. H. Hyslop[3] presents a small series of cases in which transitory diplopia occurred and had a significance which is worthy of discussion.

In eliciting a history of this symptom, it is important to differentiate distinct double vision from mere blurring or indistinctness of objects. It is not uncommon to have a patient say that he sees double at times, yet on questioning it is manifest that the patient refers merely to indistinctness of objects. Of course, errors

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(3) Jour. Amer. Med. Ass'n., Apr. 12, 1924.

of refraction and muscular insufficiency may produce such phenomena, which one might regard as milder degrees of real diplopia. However, the characteristic of genuine transitory diplopia is that objects will suddenly appear with two images, one of them distinct and the other blurred. In the diplopia here discussed, the symptom occurred quite independently of use of the eyes, was sudden in onset, and would continue for a few seconds, or at times a minute or two.

There are many causes for transitory diplopia. It may occur in multiple sclerosis, during the attacks of Ménière's disease, and in lesions affecting the function of the ocular muscles—basal meningitis, intrapontile and extrapontile tumors, vascular lesions of the pons and midbrain, epidemic encephalitis, and pressure on one or more of the nerves supplying the eye muscles. Infection of the teeth and cranial sinuses may produce paralysis of the ocular muscles, and some authors state that reflex spasm of the ocular muscles to produce transient binocular diplopia may be due to similar infections. In the latter event, the transitory diplopia is usually more distinct than the double vision in partial paralytic involvement of the ocular muscles. Eppinger and Hess state that vagotonic persons frequently have anomalies of muscular control of the eyes. They do not describe or illustrate what they mean, but the statement suggests that in some way the cerebral portion of the autonomic may at times, when the entire autonomic is in a state of overactivity, influence momentarily the tonus of the muscles supplied by the oculomotor nerves. Perhaps this sort of phenomenon might be regarded as analogous to the extrasystoles occurring in "vagotonic" persons. In the so-called reflex accommodation spasm, when sinus or dental infection is an associated condition, the mechanism is evidently in the nature of a local reflex.

Perhaps this type of diplopia should have a separate designation. Transitory diplopia is not quite descriptive. Spasmodic diplopia might be a better term. It implies its transitory nature, yet differentiates it from the transitory diplopia due to weakness of the ocular muscles caused by any one of a variety of conditions.

In certain types of pituitary disturbance there may occur a temporary swelling of the pituitary body so that there is pressure on the walls of the cavernous sinus, and that during the headaches there may be present ophthalmoplegic phenomena which will include diplopia, strabismus, ptosis or pupillary abnormalities.

Muscular insufficiency or refractive errors cannot account for the diplopia. Ordinarily, accommodation spasm associated with refractive errors produces diplopia on distant vision; but such diplopia is not so fleeting as that described here. Of the seven patients of the author, three had normal vision; two wore glasses that properly corrected their refractive errors; one with astigmatism had her glasses refitted without relief, and one was myopic, the refractive error being corrected with glasses. Of course, eye strain has been held responsible for some cases of gastro-intestinal disturbance; but such an explanation for the vagotonic phenomena described in this series of cases would indicate a lack of clinical perspective. If gastro-intestinal symptoms can be reflexly due to eye strain, one might think that gastro-intestinal disturbances might reflexly produce some disturbances of ocular function. Perhaps the statement of Eppinger and Hess, that vagotonia may present abnormalities of muscular control of the eyes, supports such a hypothesis. Accommodation spasm has been mentioned as one of the manifestations of vagotonia, but in the author's experience this accommodation spasm is more persistent.

Seven patients had symptoms referable to an overactive vagus function, and all had a transitory diplopia not easily explained by the usual causes and not related to use of the eyes.

The diplopia is best explained as a manifestation of the state called vagotonia, is analogous to the cardiac extrasystoles observed in vagotonic states, and is due to a brief spasm of certain muscles supplied by the oculomotor nerves.

THE EYE AND THE EAR.

The Relationship Between Diseases of the Ear and Eye. For some time past much has been written concerning the relationship between diseases of the eye and the nasal cavities with their accessory sinuses, but with the exception of the ophthalmoscopic appearances of the optic disc in cases of suspected brain abscess from middle ear suppuration and the question of nystagmus in labyrinthin involvement, the articles which have appeared in our medical literature on the relationship between diseases of the eye and ear have been quite limited in number.

The advanced conservative radical treatment of diseases of the nasal cavities has certainly had a very marked influence in lessening many diseased conditions of the eye, notably that of the lachrymal apparatus, for where we formerly saw dozens of patients in our clinic with probes in their lachrymal ducts, now we see but half the number. This is attributed to the attempt being made to give the nasal cavities freer ventilation by the removal of all obstructions.

On the other hand, with the exception of a few scattered articles, notably those of Moos, Rohrer, Rollet and Park Lewis, there have been but few clinical presentations of the relationship between diseases of the eye and those of the ear.

It has been only within the last few years that the teaching of otology in our medical schools has been given an independent chair or an association with rhinolaryngology, as prior to this time it was quite universally associated with the chair of ophthalmology, especially in the smaller medical schools. While such a relationship seems anomalous in the light of our present studies in otolaryngology, there nevertheless exist some clinico-pathologic grounds for it, as is exemplified by the reports from those whose daily practice embraces diseases of both the eye and the ear.

While it is a fact that the otolaryngologist may work almost independently of the ophthalmologist, the reverse is certainly not the case, as has been forcibly demonstrated during the last few years. No man can be a thorough ophthalmologist without having considerable knowledge of otolaryngologic diseases. He who daily observes diseases of the eye, ear, nose and throat, who studies closely the correlationship of these organs with certain diseased manifestations in each and the end results of their treatment, is certainly more capable of making a correct diagnosis than the man who has to consult a colleague who in turn only sees and draws conclusions from certain local appearances and who can never thoroughly imbibe the history of the case. Such pioneer workers in ophthalmology as Knapp, Greuning, Sattler, Kipp and others recognized this fact years ago and became thoroughly familiar at the same time with otolaryngological diseases.

With this preface, Dunbar Roy[4] contributes the following review of the literature bearing on the relationship between diseases of the eye and the ear.

It was the ophthalmologist who first pointed out the presence of nystagmus in certain diseased conditions of the middle and internal ear, a subject which of late has occupied much time in otological discussions.

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(4) Southern Med. Jour., June, 1924.

1. *Affections of the eyes which have been attributed as the cause of or at least closely related to certain aural disturbances.* In an interesting and scholarly article published in the *Archives of Ophthalmology,* July, 1922, Prof. J. Van Der Hoeve, of Leiden, Holland, has discussed the clinical relationship between the eye and the ear. He mentions the relationship of a peculiar disease known as blue sclerotics to deafness existing at the same time. This disease must surely be indigenous to certain European countries, since inquiry has revealed the fact that our American colleagues are not familiar with the condition. According to Prof. Hoeve, these patients suffer with a peculiar grey-blue or slate-blue color of the whites of the eye accompanied by the presence of very brittle bones of the extremities which are most easily broken or fractured on the slightest exposure to traumatism. The peculiar relationship to the ear is the fact that in nearly all of these cases the patient becomes deaf, giving all the symptomatic tests of otosclerosis.

Another eye affection mentioned by this writer which is sometimes seen in conjunction with eye diseases is the presence of pigment degeneration of the retina, as illustrated in retinitis pigmentosa. When we realize the fact that optic atrophy very frequently becomes a concomitant symptom in retinitis pigmentosa, we very naturally surmise that atrophy of the acoustic fibers could also take place in the course of this disease. Congenital syphilis will always be recognized as an obscure etiology in many of these cases which must very naturally lead us to the recognition of this accidental relationship.

The possibility that deafness may be caused by sympathetic ophthalmia has been held by some observers. Snellen contended that the deafness was produced by the extension of the inflammation from the sheaths of the optic nerve to other like structures at the base of the brain.

In 1898, Rohrer, in a very exhaustive article on this subject, suggested an ingenious embryological and histological relationship between the eyeball and middle ear. He makes the cornea homologous with the promontory and the pupil with the labyrinthin windows; the conjunctival sac with the middle ear and the nasal duct with the tuba eustachii; the tear glands with the acinous glands of the tube, and the drum membrane homologous with the membranous portion of the eyelids.

Ostmann, in 1897, called attention to the fact that the eye is much more commonly affected by the ear than vice versa. Affections between these organs may be induced through reflex radiation and combined stimulation of the motor fibers or indirectly through otitic diseases of the brain and cerebral meninges. The nerve tracts which permit these relations between the eye and the ear according to this author are the trigeminal, facial and acoustic nerves; the latter give rise to a great variety of reflex effects upon the eye according to the involvement of the vestibular branch (static function) or the true auditory nerve, the cochlear branch. Both the eye and the ear are abundantly supplied with sensory fibers from the trigeminus, accounting for the pain in the eye that is felt in severe middle ear suppuration. The facial nerve establishes a communication between the eye and ear by innervating the stapedius muscle on the one hand and the orbicularis palpebrarum on the other. It is for this reason that a deep humming sound in the ear is perceived on tightly shutting the eyelids, which is interpreted as a muscular bruit originating from the stapedius.

As a corollary to this, Moos has reported a case of a woman 60 years old who had a ringing in her left ear whenever she put on her nose glasses and when she removed them the noise disappeared. This was attributed to a reflex spasm of the stapedius muscle.

Dr. George Stevens, in 1881, before the International Medical Congress, reported several cases where aural tinnitus was diagnosed as due to a muscular imbalance in the eyes, relieved by graduated tenotomies of certain extra-ocular muscles; and Dr. Theobald, in 1909, before the Section of Ophthalmology of the American Medical Association, reported four cases besides having observed many others where certain aural disturbances such as tinnitus, muffled and stuffy sounds, and even vertigo were entirely relieved by the correction of definite eye strains.

A case has also been reported by Rollet where a tinnitus was produced whenever the ophthalmoscope was used in the eye on the same side, which ceased immediately afterwards.

D'Arsonval has reported deafness for two hours following the looking at a Voltas light for a few minutes, and he believes that it was due to the irritation produced by the ultra violet rays.

Moos, in 1898, reported a case of bilateral panophthalmitis following bilateral cataract extraction, which was followed by meningitis and finally complete bilateral deafness, a case of direct extension of the pathologic process rather than reflex radiation.

DeCapdeville has reported two very unique and interesting cases. The first was a blacksmith into whose left eye had been driven an iron chip. The chip produced considerable traumatism, but was finally extracted. However, severe inflammation followed and on the twentieth day after the accident the left ear began to be affected with tinnitus and deafness. Nothing abnormal could be discovered about the ear. Finally the eye was enucleated and on the next day all subjective phenomena in the ear had disappeared and the hearing became normal. In the second case he reported a woman who four months after a cataract extraction showed some ciliary infection and later severe iridocyclitis with supra-orbital pains. Following a subsidence of the acute pain, the ear on the same side became affected with tinnitus and diminution of hearing, so much so that finally the hearing disappeared entirely and the eye symptoms continued. Enucleation was performed, which relieved the tinnitus and vertigo, but the hearing remained defective. To these cases can be added those of Dransart.

In the first case a tinsmith 28 years old was injured in the left eye by a chip of iron. This chip was removed, but traumatic changes were left. Later the patient received a blow in the right eye and this was followed by deafness in the right ear. Later an iridectomy was made in the right eye, which was followed by improved hearing on the same side.

The sixth case reported is startling.

A journalist 56 years old had entropion of the right lower lid. At the request of the patient this was operated upon with good results. Following this the patient, who had been deaf since his eighth year, reported that he could hear perfectly well.

Bouchut relates the case of a young man who was struck by a ball over the right eye, which produced a contusion and finally dimness of vision. This was followed by almost complete deafness in the corresponding ear. These cases certainly seem unique and must be considered in the light of severe reflex irritation rather than as the results of any direct pathologic relationship.

2. *Affections of the ear which have been attributed to be the cause of certain ocular disturbances.* Here we realize that every ophthalmologist should be familiar with the ear if he wishes to be competent to make a complete diagnosis.

During the last two or three years our medical journals have been filled with clinical reports and discussions on labyrinthin diseases of the internal ear, and especially with the question of nystagmus as a means of diagnosis.

No one could underestimate the wonderful scientific work which has been done by Barany and others as an aid to the differential diagnosis of internal ear diseases, and no one knows better than the ophthalmologist the difficulty and uncertainty which surrounds the question of nystagmus and how frequently it can be made manifest in diseases other than those of the internal ear.

The aurist and ophthalmologist must work together if this symptom is to be recognized as one of positive value, which again teaches us that it is of distinct assistance for the aurist to be a good ophthalmologist.

The effect of labyrinthin changes and of brain abscess upon the eyes has been too extensively considered and discussed for further comment.

Affections of the ear, especially middle ear diseases, have long been known to be capable of giving rise to ocular paralyses. In the majority of cases the paralysis involves the external ocular muscles on the side corresponding to the otitis and it appears independently of meningitic symptoms.

The study of the anatomico-physiologic relations between the organs of hearing and of sight readily explains such an effect of the ear upon the ocular apparatus, but the difficulty is to interpret the symptoms and to establish the pathogenesis of ocular palsies of otitic origin.

According to Urbantschitsch they were first vaguely considered as reflex disturbances. Later, under the influence of the microbic theories, according to Berger, they were attributed to infectious neuritis due to toxins produced by ear infection.

Numerous cases have been observed by Gradenigo, Terson and others, however, in which the paralysis very probably owed its origin to the direct propagation of an infectious lesion. Of course this is not intended to cover the grave cases of otitic suppuration, giving rise to severe cerebral complications (abscess of the brain, meningitis, intra-cranial thrombophlebitis) where the infectious origin cannot be doubted. The ocular-motor paralysis in these cases is merely a side phenomenon of secondary importance.

The so-called "Gradenigo symptom-complex" has been frequently recognized in the last few years, although its etiology is still a mooted question.

The occasional occurrence of paralysis of the sixth nerve in affections of the middle ear is accounted for according to most authors by the special relations between otitis and this nerve through the carotid canal, while Perkins believes that the majority of these cases are due to osteitis of the petrous tip.

Cases of sixth nerve palsy have been reported in conjunction with middle ear and mastoid suppuration usually on the same side, although the writer has reported a case of sixth nerve palsy occurring on the side opposite the mastoid involvement. Perkins, of New York, has written quite extensively on this unique subject and in all subsequent articles he has been extensively quoted.

A series of noteworthy contributions to this subject were published by P. Bonner, who, in 1893, called attention to the labyrinthin oculo-motor connections and gave as labyrinthin symptoms the oculo-motor disturbances through radiation, such as strabismus, diplopia, miosis, etc. Bonner in the same year also reported an observation on a patient who suffered repeatedly from disturbances of accommodation in the right eye after strong injection into the right ear for the removal of cerumen and even became presbyopic for several hours, all of which disappeared with the removal of the cerumen. While the occurrence of reflex paralysis seems to have been demonstrated clinically as well as experimentally for the external recti of the eye, the problem is not so clear in cases of the other muscles.

DeLapersonne observed a case of paralysis of the superior oblique which he thinks referable to the same origin. Not only the extrinsic muscles of the eye, but also the intrinsic muscle tissue may present reflex paralysis in consequence of an ear lesion. Paralysis of accommodation has been reported (Boerne Bettman) as also mydriasis and miosis. Such an occurrence does not even seem to require a serious reaction on the internal ear such as takes place in the presence of vertigo, severe pain, tinnitus and deafness. A weak irritation sometimes suffices and the starting point may be the external ear.

Sabrazes reported a case of unilateral mydriasis caused by the presence of a fragment of barley in the external auditory canal. An analogous case was published by Brandelier, where the foreign body was cerumen around a glass bead.

According to Moos, an infectious process of the ear may be propagated from the petrous bone to the meninges, along the trigeminus as far as the gasserian ganglion and according to Wiethe by way of the tympanic and pterygoid venous plexus as far as the ophthalmic vein, where it gives rise to an orbital abscess.

Urbantschitsch has reported a case where a dilatation of the pupil was induced in a patient by the rapid change of air pressure in the tympanic cavity; and cases where a suppurative process of the middle ear has influenced the dilatation and contraction of the pupil have been reported by Moos, Schwartze, Gelle and Gervais. Certain observations as to reflex action on the muscles of the eyelid have been made.

In a case of Desterne's a single air douche of the middle ear was followed by the cure of a twitching of the right eyelid which had persisted for over a year. Schwartze mentions the cure of a ptosis after the removal of an ear polyp. Blepharospasm due to the introduction of an ear speculum was noted by Buerkner, and Buzzard observed blepharospasm due to a plug cerumen in the auditory meatus. Ostmann, while mentioning these reported cases of seemingly reflex paralysis and spasm, does not believe in the reflex irritation theory, but thinks that such is rather due to intra-cranial complications. Kipp, as early as 1884, reported two cases of metastatic panophthalmia in connection with middle ear suppuration and this very observant ophthalmologist was one of the first men to call attention to the symptom of nystagmus in connection with severe middle ear diseases, a fact which should always be remembered in discussing the history of labyrinthin diseases.

In this connection should also be mentioned that Qitamura has reported a case of metastatic ophthalmia as a sequel to sinus thrombosis. Urbantschitsch, in 1908, contributed a very lengthy and an exceedingly interesting article on "Subjective Acoustic Phenomena and Subjective Visual Concepts", in which he dealt with sensations of sound and color which accompany unconscious cerebration. Various color sensations may modify the subjective perception of musical composition. Simultaneous excitation of the two eyes by different colors produces changes in the subjective hearing which do not occur with one.

Prof. Peters, of Rostock, published in Vol. 36 of Knapp's *Archives of Ophthalmology* an article on miner's nystagmus, in which he undertook to show that this condition could be well accounted for by the influence of the vestibular apparatus of the ear on the movements of the eye, particularly nystagmus. He shows good authority for such ideas as founded on the experiments of Breuer, Ewald and others.

That nystagmus is produced through irritation of the semicircular canals is now fairly well established, as the number of cases reported in the last two years by otologists will testify. The prominence of this symptom is shown by Barany and others as a diagnostic sign of vestibular irritation. Peters' argument is by no means illogical and certainly opens a new field for further investigation.

The author would urge otologists as well as ophthalmologists to bear in mind these relations, because many mistaken diagnoses have been made by not considering the interdependence of the various organs of the body.

THE EYE AND THE TEETH.

Elective Localization in the Eye of Bacteria from Infected Teeth. An etiologic relationship between chronic foci of infection and systemic disease is accepted by most clinicians. The cure or marked improvement in some systemic disorder which may follow the removal of a septic focus seems conclusive proof of a causal relation. The clinical manifestations of focal infection depend primarily on the site of localization of the bacteria which are fed into the blood stream. The extent of clumping of the organism, the nature of the blood supply, the food supply and local tissue resistance must play important parts in determining the localization and resulting infection.

Rosenow has emphasized the individual variation in bacteria and has advanced the theory that bacteria have a specific tendency to localize in certain tissues of the body, dependent on some peculiar inherent property. The theory is a most attractive one and has evoked a great deal of discussion. If it is true that bacteria have peculiar localizing or infecting powers, many obscure phenomena of disease are explained.

The theory concerns especially the streptococci commonly associated with chronic disease of bacterial origin.

A close clinical relationship between oral sepsis and infections of the uveal tract has long been recognized. Butler, in a study of 100 cases of infection of the uveal tract, decided that 12 per cent were definitely due to oral sepsis. He considered that the etiology of 41 per cent was doubtful, but concluded that probably a large part of these originated in oral sepsis. B. T. Lang classified 71 out of 176 cases of eye infection as due to septic foci about the teeth. William Lang thought that pyorrhea was responsible for 139 of 215 cases reported by him. De Schweinitz sums up the question in the statement that there is "no better established etiological relationship than that between sepic foci in dental areas and certain diseases of the eye, especially those of the uveal tract." Such conclusions are based largely on the clinical improvement noted after the eradication of foci of infection.

There is little experimental proof, however, of a relation between focal infection and eye disorders. Irons, Brown, and Nadler studied a streptococcus isolated from the infected tissues of a patient suffering from dacryocystitis and iritis. They found that a large percentage of rabbits developed eye lesions when injected intravenously with the freshly isolated culture. The ability to produce specific lesions was lost on subculture and on passage. The loss of specific tendency to localize in the eye was not accompanied by any demonstrable decrease in virulence for rabbits. Rosenow has reported cases of eye infection from a dental pulpitis with the reproduction of the lesion in animals.

R. L. Haden[5] has made a bacteriologic study of tooth infections. Positive cultures were obtained from the root tip or pulp of one or more teeth of fifteen patients

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(5) Arch. Int. Med., December, 1923.

suffering from metastatic eye infections. Staphylococci and streptococci were the only organisms recovered. Streptococci were found almost constantly as the predominant organism. Staphylococci were occasionally observed in pure culture but were usually present only in small numbers in association with streptococci.

Sixty-six rabbits have been injected intravenously with the bacteria isolated. At least two rabbits were injected with the single culture or the mixed cultures from a patient. Two animals were used for the culture from each tooth found infected in several patients. Forty-five, or 68.2 per cent, of the sixty-six rabbits developed eye lesions. The positive findings include one or more rabbits from fourteen patients. The one patient whose cultures produced no syphlitic lesions was found later to have a positive Wassermann test.

As a control on these results we have the result of the inoculation of 169 rabbits by the same uniform technic with the cultures from the teeth of patients who were suffering from no systemic disease or from systemic disease other than infection of the eye. The most common anatomic lesion was an iritis or iridocyclitis. Some animals showed multiple hemorrhages in the iris, limbus or sclera, cloudy fluid in the anterior chamber, cloudy cornea and hyalitis. Pericorneal infection often developed a few hours after the inoculation. In some animals the infection was progressive; in others it disappeared, only to reappear at a later date with an evident infection.

Histologic examination of the eyes showed infection of vessels, or hemorrhage in the iris and ciliary body in some specimens. Others showed the diffuse inflammation of a panophthalmitis, including the extra-ocular muscles. Still others showed a marked cellular infiltration of the choroid. One showed only an infiltration of cells in the vitreous humor. (Frontispiece, Plate I.)

Ocular Tuberculosis. A general survey of ocular tuberculosis in its especial relation to tuberculin used for diagnostic and therapeutic purposes, is given by W. E. Gamble.[6] The writer finds that in ocular tuberculosis the remedy has stood the test of twenty years' experience.

Ocular tuberculosis is a chronic disease, comparable to the disease elsewhere in the body. Tuberculosis of the eye in the Middle West is infrequent; while in European cities it is comparatively common. It is found in ambulatory cases; in office practice and in outdoor dispensary service, commonly without evidence of the disease elsewhere. Tuberculosis, well developed, in other parts of the body seems to make the eye comparatively immune. The author attended the wards of a tuberculosis hospital for five years, hoping to observe ocular tuberculosis, without seeing a case. The disease probably does not extend to the meninges, nor become disseminated to other parts of the body. The box like character of the eye may partly explain this. All structures of the eye may become the seat of the tuberculosis process except the lens, and it indirectly, by having its nutrition disturbed by cyclitis.

Clinical Pictures. The recognized clinical pictures of ocular tuberculosis have greatly increased in number during the last two decades. It is not so long ago that about the only generally recognized form of tuberculosis of the eye was miliary choroidal tubercle. The fuller appreciation that this disease takes the nodular form, modified by the tissue in which it exists, has made the differential diagnosis from other inflammatory diseases of the eye much easier.

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(6) Amer. Jour. Ophth., November, 1923.

It is in the masked types of the disease that use of tuberculin has aided greatly in making the diagnosis; for example, benign types of choroiditis, nodular episcleritis, proliferating retinitis, retinal hemorrhage in young men, neuritis and neuroretinitis resulting from tuberculous nodules in the optic nerve sheaths, etc.

Diagnosis by Tuberculin O. T. Changes in tuberculous area resulting from diagnostic doses of tuberculin (O. T.) manifest themselves in terms of injection of vessels, in exudate, in hemorrhage (retinal vessels), in reduction of sight, and in tenderness on pressure. In only about 25 per cent of ocular tuberculosis is focal reaction by tuberculin obtainable. It is commonly seen and most easily recognized in tuberculous iritis. It is least commonly seen in conglomerate tubercle, and then only by use of massive doses.

In optic neuritis or neuroretinitis caused by tuberculous nodules in optic nerve sheaths, the reaction is reduction in sight in the affected eye, coming on 17 to 24 hours after injection and lasting four days, with return of sight to what it was before the injection. This sight reaction test is justifiable when other means of diagnosis have failed. No reports of damage to eyes have been made. The Viennese physicians (Novak) used diagnostic doses (2-5 mg. O. T.) for treatment as well as for diagnosis in conglomerate tuberculosis in the posterior part of the eyeball and uvea, repeating the dose every 48 hours as long as thought necessary. The diagnostic dosage varies in different hands from 1 to 5 mg. O. T., given subcutaneously at varying intervals, with a tendency to the use of smaller doses in this country. The writer has seen focal reaction produced by 10-500 mg. T. R. without general reaction. More careful study of the tuberculous area before and after the dose, by means of corneal loupe, slit lamp, etc., will bring to light the reaction that otherwise would escape detection. The ideal dose is one that will produce focal reaction and falls short of causing general reaction.

Therapeutic Use of Tuberculin. Tuberculin has been used in Europe and America for the last twenty years in the treatment of ocular tuberculosis and it has stood the test of time. It is in chronic small foci, that the remedy is most effective. In large masses of tuberculosis tissue, the therapeutic use is not satisfactory; oftentimes, of no use whatever. We are still at sea as to dosage. Von Hippel taught to begin with 1-500 mg. T. R., gradually increasing the dose every second day to 1 mg.; never repeating a dose sufficient to produce reaction. Sir A. E. Wright advised giving infinitesimal doses (1-5000 to 1-2000 mg.) on the theory that this amount is sufficient "to activate the formation of antibodies." He said there was danger of paralyzing that function by using large doses. Practice in America, in the main, follows the Von Hippel method, with a tendency to use smaller doses than at first practiced, and the same may be said of the practice in England. The Viennese ophthalmologists use the infinitesimal doses (B. E.) for small foci. For therapeutic purposes they begin with 1-1000 mg. (B. E.) subcutaneously and increase the dose gradually to 1-10 gm., given every other day at first, and later on once or twice a week and prolong the interval to 7-8-10-12-14-16-20 days. When the higher dosage is reached cold abscess may occur at site of the injection, which they interpret to indicate the patient's relative maximum dose, which dose should not be increased. The dose should not, in any event, be larger than 1 mg. (B. E.)

While the temperature curve is, in many cases, a delicate criterion for guidance, the writer is of the opinion that the clinical symptoms, in terms of headache, malaise and the loss of appetite, increased pulse rate, etc. are oftener more delicate and less harmful a test. Indeed, safety in the administration of this remedy lies in a dose far below that which produces untoward symptoms. On the contrary, a feeling of well-being, good appetite and increasing weight is good evidence that the patient is getting the proper amount of tuberculin.

The Specificity of the Tuberculin Reaction. For diagnostic purposes the specificity of the tuberculin reaction cannot be successfully questioned. The most convincing proof has been furnished by the veterinarians. Their results with the test is almost 100 per cent perfect as checked up by immediate autopsy. Frankel in a study of 8,000 cattle, tested by tuberculin and checked up by autopsy, found only 3 per cent. error. Voges, in 7,000 tests, found 2¼ per cent. error.

The specific action of tuberculin as a therapeutic agent is not so susceptible of demonstration. There are clinicians whose opinions must be considered, who believe it has no specific action on tuberculosis tissue; but has therapeutic value in common with other bacillary foreign proteins.

Just what part the antibodies stimulated by tuberculin play in the healing process is yet to be determined. Wright believed them to be the controlling factor. Recent work of Wassermann, Coulthard and others indicates that the antibodies produced by the killed tubercle bacilli, in tuberculous animals, produce a complement fixation in certain cases, and that this is independent of a positive Wassermann. Coulthard, Bordet and Gingou found that this immune reaction was elicited only in animals in which the bacilli were killed or nonpathogenic (avian) bacilli were injected; and further, that in animals subsequently injected with virulent strains death was retarded but not prevented. Antibodies were not present when virulent strains were used. These observers found the results to be similar in humans. Acute phthisis, acute miliary tuberculosis, tuberculosis meningitis show little or no antibody formation, as evinced by the complement fixation method; while in chronic cases, when tolerance to the injection is high and the patient relatively well, the production of antibodies is great. Pari passu with the diminution of resistance to the tuberculosis process the antibody lessens. It is to be hoped that this Wassermann tuberculous reaction will prove to be of practical value in diagnosis. Coulthard believes this test to have more value in prognosis than in diagnosis. He says "A strong positive reaction means a well developed resistance to the tuberculous disease and a relatively long lease of life may be expected; on the contrary, a weak reaction in a well established case indicates lack of response to the infection and, therefore, guarded prognosis."

That the therapeutic value of tuberculin lies in the production of hyperemia and the resultant fibrosis in and about the tuberculosis nodule, thereby isolating it, must be considered. The idea is well put by Kraus as follows: "It is a well known principle of pathology that chronic passive congestion is followed by fibrosis. Tuberculin, in proper dosage and spacing of injections, can elicit a series of mild alergic shocks about the focus of disease, maintaining a more or less constant degree of hyperemia. Evidence indicates that this is followed by fibrosis and fibrosis is greatly to be desired; therefore, in chronic tuberculosis, where lesions are located in a certain organ or organs, the administration is advantageous."

Progress in the problems that confront the physician in the use of this complex organism is waiting on the further study by the physiologic chemist, aided by the clinician. It will not be made until the dose is standardized and this result will not be attained until the harmful part of the bacilli is separated from the useful, and a fuller knowledge gained of the difference in effect of the toxin and the endotoxin on tuberculous tissue. Koch used the toxin (filtrate) for diagnostic purposes and the endotoxin (ground up bacilli) for therapeutic purposes. Practice has followed his lead ever since.

OCULAR THERAPEUTICS

Autogenous Serum Treatment of Neisserian Ophthalmia After Barrage Doses of Vaccine. There has been little added to the treatment of gonorrheal infection of the eyes in the past twenty-five years that justifies any definite assurance of good results in any case. The general statistics following this infection show blindness in over 90 per cent. The normal course of the infection with present applied therapy covers so long a time that the corneal cuboidal mucous membrane is irreparably damaged, and followed invariably by scar tissue and opacity or loss of entire eye ball. The ultimate degree of vision is dependent upon the final result to the cornea.

The following case, reported by E. O. Houda and A. E. Hillis,[7] is so unusual, it is given here in detail.

A young professional man of 31 years, with a negative past history in so far as a Neisserian infection or lues is concerned, and with general good health apparently, was seen for the first time on the second day of an acute conjunctivitis in one eye. The left eye showed considerable edema of the lids, a beginning edema of the bulbar mucous membrane and a profuse mucoid discharge with little pus.

He was placed upon mild irrigations with boric acid and instillations of argyrol and cold compresses. The second day there was no improvement, the eye being much worse. Smears from the discharge showed a gram negative intracellular diplococcus, three different laboratories giving the same report. Cultures were

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(7) Northwest Med., October, 1923.

negative. The negative cultures precluded the consideration of the diplococcus of meningitis which morphologically resembles the gonococcus.

He was taken to hospital and under constant attention the regulation treatment by irrigations and silver preparations was instituted. With this he was given what the authors have named barrage of doses of stock mixed Neisserian vaccine. On the seventh day, in spite of prophylaxis, the other eye was involved, starting with an edema of the conjunctiva of the lower cul-de-sac, including the bulbar mucous membrane, associated with a copious mucoid discharge. On the eighth day the outer canthus of the first eye was lanced to allow better irrigation and drainage, so intense was the edema of both lids.

An incident took place at this time upon which the serologic treatment got its inception. The rapidly increasing edema of the second eye called for an incision of the outer canthus on the tenth day, the third since its beginning. The clinical picture on this day presented both eyes terrifically swollen, the bulbar conjunctiva intensely injected and edematous. The edema was so intense that the mucous membrane of the balls rolled over both corneæ. The second cornea was slightly hazy and the first apparently shot beyond repair, being covered in great part by granulations.

The rapid change for the better, after institution of the serum treatment together with the bacteriologic changes, could not be attributed to the mere lancing of the canthi. On the tenth day the second eye called for an incision of the outer canthus. The first eye was irreparably damaged and the second was going the same route more rapidly.

The incident upon which the serum treatment was developed took place after the lancing of the first canthus. A persisting mild hemorrhage from a small artery caused a flow of blood through the conjunctival sacs for about one hour. This was finally stopped by ligature. The character and volume of the discharge for a number of hours after this was noticeably changed for the better. This change lasted not more than twelve hours. The next day there was a resumption of the prelanced stage. Grasping at any change in treatment to prevent total blindness, the serum treatment was applied to the eye which was irreparably damaged and which could not be damaged further by a trial treatment. This was applied on the ninth day. Fifty to sixty centimeters of blood of patient was taken, this allowed to clot, after which the serum was taken off and centrifuged to get a perfectly clear serum free from cells. Five to six drops of this was instilled into the eye every fifteen to twenty minutes, day and night. The silver treatment was not interrupted, but the irrigations were discontinued.

Before twenty-four hours passed, there was an undisputed clinical improvement in the character of the discharge. The quantity was greatly reduced and practically all subjective symptoms disappeared. The serum, to use the patient's words, acted ''like oil to a dry flivver cylinder.'' His further comment was that it was the only thing that had been done which gave him the first relief from almost constant discomfort.

The rapid and absolute change for the better left little question of doubt in the efficacy of the serum in this case. The next day the outer canthus of the second eye was lanced and the serum treatment was applied as to the first eye, with an identical prompt response. This serum treatment was continued until there was no question of a possible recurrence, and for its soothing effect.

At the end of seventy-two hours after the institution of the treatment in the first eye all smears were negative and have remained so for both eyes. He left the hospital after eight days of serum treatment. The last four or five days the treatments were gradually reduced to longer periods of time. For about one week after leaving the hospital the serum was applied at long intervals for its soothing action.

During the entire course of this treatment it was necessary to puncture a vein and withdraw blood for its serum as often as was needed to keep a constant supply on hand. The exact number of times was not recorded. The total number did not exceed eight. Fifty to sixty cubic centimeters would give a sufficient amount of serum to last twenty-four hours when used intensively, in the beginning of treatment. This is kept at ordinary room temperature.

The barrage doses of Neisserian vaccine given in the first six days consisted of two cubic centimeters of a stock mixed vaccine, at forty-eight hour intervals. The term barrage is used to distinguish from the regulation small dose given at one point of injection. The two cubic centimeters are split into four parts, injecting each part at a distant point. A single large dose of two cubic centimeters at one point would produce a violent local reaction with a possible abscess, whereas the divided distribution seemed to produce little local or general reaction.

There is no question that the use of this vaccine produces antibodies against the diplococcus. The failure to clean up local infections by its use lies in the fact that the infection is a surface one and does not get into intimate contact with the serum. Its good effect in arthritis apparently lies in the fact of antiseral antibodies coming in intimate contact in the tissues with the bacterium. The large doses given in this case were used in the hope of having some good effect in a serious infection. There was apparently little direct response to its use, in so far as the local eye infection was concerned.

Many interesting questions suggest themselves in this case study. Would normal serum have the same effect as the autogenous serum used in this case? After the massive vaccine doses there must be a high amboceptor content developed from the antigenic properties of the vaccine which, according to Ehrlich's theory of hemolysis or bacteriolysis, completes a perfect trinity—the union of complement, amboceptor and bacterium, followed by a prompt inactivation of the living virus, its destruction and a resolution of the effects of the infection. The earlier this can be applied the sooner the entire cure takes place.

While this is a report of but one case, the principles involved are such that direct experimental work along these lines may develop a specific stock serum for an affection which contributes no small percentage to blindness, especially in babies.

Antidiphtheric Serum in Ocular Infection. Protein therapy has become very popular, perhaps too popular. Innumerable kinds and varieties of protein or non-specific agents have been employed, most of them having more or less constitutional effect on the patient. This therapy has suffered in the opinion of the profession in previous years because it was opposed to or unexplained according to known standards of bacterial activity in the human body. But the place of protein therapy in general medicine and in ophthalmology is becoming stronger and more appreciated each year, with the increasing reports of clinical results and more definite experimental data.

Ben Witt Key[8] reports his observations from an experience over a period of six years, on a total of ninety-one cases. In all these cases he injected antidiphtheric serum. Of these ninety-one cases, forty-eight were hypopyon keratitis; eighteen were infections of the anterior segment (fourteen after accidental penetration, four postoperative); eleven, panophthalmitis; and fourteen, ulcus serpens.

Hypopyon Keratitis. Of all the cases of hypopyon keratitis (forty-eight in number), thirty-eight were in patients over 40 years of age, and most of these were over 55. This observation has been a consistent one and bears out the usual history, since it is well known that hypopyon keratitis occurs commonly in the aged and often debilitated individual, frequently following on the neglect of a local injury. Moreover, it is in keeping with the two fundamental theories as to the biologic alterations which take place in the organism after injection of a nonspecific agent; namely (1) those that involve cellular stimulation, the "plasma-activation" of Weichardt, and (2) those resulting from alterations in the permeability of the body cells, studied by Luithlen, by Starkenstein and others and which represents a diaphasic phenomenon.

The treatment was similar in all cases: cauterization with phenol (carbolic acid, concentrated) followed immediately by alcohol (50 per cent.); in advanced cases, multiple incisions through the ulcerated area, followed by the phenol and alcohol cauterization. Antidiphtheric serum, from 1,000 to 5,000 units (varying with the age and weight of the patient), was injected at the earliest possible moment, this dose being repeated or modified in from twenty-four to forty-

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(8) Jour. Amer. Med. Ass'n., Jan. 19, 1924.

eight hours, depending on the reaction observed after the previous injection, and repeated as often as seemed advisable in the individual case. The usual local treatment of hot fomentations, atropin and an ointment containing 1 part of mercuric chlorid in 5,000 parts of petrolatum, was fairly routine in all the cases. In a series of five cases, subtenon injections of warm hypertonic (2 per cent.) salt solution at from three to twelve hour intervals after injection of the serum were given for the purpose of increasing locally the flow of lymph, increasing the permeability of the capillaries and stimulating leukocytic activity.

Observation of these cases for changes, reactions and results as they occur almost daily during the course of such intensive treatment has revealed uniformly consistent effects, so much so that they are now almost to be anticipated as the course of such a case is followed. In from twenty-four to forty-eight hours after the initial injection, the hypopyon is reduced or has disappeared; if not, a complication (as occurred in four cases, three of these syphilitic and one unaccounted for) may be found to explain the effect. Hypopyon may reappear with increased corneal and conjunctival reaction when injection of the serum is delayed or discontinued (as reported in detail in seven cases of the first series of twenty-three cases), but invariably disappears promptly when injection of the serum is resumed (the same local treatment being administered). Besides the noticeable effect on hypopyon, almost invariably there is relief of pain, rapidly subsiding conjunctival and iritic reaction and a clearing away of ulcer débris, such as does not usually occur in these cases, the ulcer itself taking on a clear and clean appearance early in the process of repair. The result of this prompt healing and clearing away of ulcer débris is found in the surprisingly mild opacities which remain, and in many instances the vision obtained is far beyond expectations.

Penetrating Wound (Infection). An analysis of the eighteen cases of infection after penetration furnishes some striking observations. In almost every case there is relief of pain, diminished conjunctival and iritic reaction, and a quieting of the infectious process as though it were transformed from a violent, inflammatory one to a definitely mild type. Very noticeable also is the clearing and transparency of the anterior segment of the eye, with disappearance of hypopyon, and this often occurs even in those cases observed late and progressing to inevitable infection of the vitreous chamber (panophthalmitis).

It is quite obvious that the best opportunity for observation of clinical effects of the serum is offered by cases of penetrating wound of the cornea with infection, because the only effective local treatment is that of hot fomentations and atropine, antiseptics being of little value; whereas, in ulcus serpens with hypopyon, the effect of cauterization and antiseptics cannot be clearly separated in many cases from the effect induced by protein injection.

Panophthalmitis. Injections of the serum were administered in eleven cases of panophthalmitis in order to observe the reaction. Restoration in any degree was not to be anticipated; nevertheless, the serum effect may be observed in these cases. Roemer says: "Any one who regards the word serum as a miracle is suffering under an illusion!"

A typical case was one observed at the very onset of the infection, receiving 5,000 units, with marked improvement in from twenty-four to forty-eight hours and relief of pain. But subsequent injections failed to check the process, and slowly but quietly, only moderate reaction being present, disintegration of the globe continued. The anterior segment, however, was clear and transparent as though *irrigated* by a lymphagogue effect of a definite systemic influence. This case was similar to nine of the eleven cases observed; two were extremely violent and were seen in the late stages of the infection.

Ulcus Serpens. In the fourteen cases of ulcus serpens observed, injection of the serum was given with confidence in the result. And these results were quite uniform and indicative of the case in which protein therapy should always be administered. Cauterization was employed in all but two of the cases, because the ulcer was of the violent type, almost invariably located centrally, most frequently developing in patients past middle life, and to delay local intensive measures in order to observe serum effect would obviously prove little and risk much. Furthermore, under such conditions, when delay was possible and justified, improvement and healing may have occurred anyway, regardless of injection without intensive antiseptic measures. Here the natural forces of resistance may have been sufficient without either injection or antiseptic aid.

The systemic reaction to inoculation of the cornea and anterior chamber with *Staphylococcus aureus* and with the pneumococcus, as affected by injections of antidiphtheric serum, was observed in a series of experiments on seventeen rabbits. (Plate XXIII.)

These experiments show consistent results similar to those which obtain in clinical investigation. While they cannot be regarded as conclusive evidence, because of the limited number so far carried out, they cannot be considered accidental in any sense.

These experiments are being continued, first with the idea of determining the effect of previously injected immunizing doses for prophylactic purposes; secondly, to establish the relative value of injections of antidiphtheric serum and normal horse serum concentrated in the same manner and containing the same nitrogen content, thereby studying the question of the diphtheric element as a possible highly potential influence in the therapeutic reaction; and thirdly, to demonstrate a maximum and minimum dosage in relation to the time and character of the infection. The significance of the time of the shock effect and the period of recrudescence, as shown in the experiments related above, are obviously of great importance in the study of this therapy.

Antidiphtheric serum has been employed recently by a few American observers in numerous indications other than those here outlined.

The indications which seem to justify its use may be enumerated as follows: ulcus serpens and hypopyon keratitis, infection after penetration and panophthalmitis, idiopathic iritis and iridocyclitis (hidden focal infection?) keratomalacia and sympathetic ophthalmia, and for prophylactic purpose in certain cases. It has been employed, however, for disease of almost every anatomic element of the eye, also for the different infections to which the eye is exposed and without regard for the pathologic or bacteriologic diagnosis. These observations are obviously confusing and doubtful and do not contribute at this time to the real value of the therapy or to solving the problem of its effect on the organism.

Antidiphtheric serum, as it is now prepared, offers perhaps the best form of foreign protein for administration to the human. Because milk varies in its potential and toxic action, numerous commercial preparations are now undergoing experimentation. Normal horse serum, "yatsencasein," albumose, proteose, nonspecific vaccines, etc., have not as yet been shown to possess with any certainty a more reactive and potential effect than that of antidiphtheric serum. Furthermore, the dosage and reaction are quite uncertain. The dosage of the serum is certainly more definite and its anaphylactic effects are more clearly understood.

The author ventures to predict that when protein effects are more clearly defined and understood and protein preparations selected perhaps for a specific reaction, the time will come when the accepted treatment of pneumococcic and staphylococcic infection of the refractive media of the eye, in addition to local treatment, will consist in the administration of a foreign protein as soon as it can possibly be injected, just as now antitoxin is demanded immediately and in sufficient dosage in the treatment of diphtheria itself.

Tuberculin in Tuberculous Iritis. Tuberculosis of the eye is secondary to tuberculosis of the lungs. In tuberculous iritis we look for a primary focus in the lungs as confidently as we look for a similar focus in cases of tuberculous meningitis or tuberculous nephritis.

A small, healed or rather semi-healed focus in the extreme apex of a lung is able to do two things. It may at certain intervals send out deputations of living tubercle bacilli which find a favorable soil in some distant tissue. It may, and frequently does act as a fixed focus of infection from which no living germs escape but from which a constant stream of toxins pours forth to set up irritations, pains and inflammations in various parts of the body which bear no distinguishing characteristic of a tuberculous nature. To this class belongs the troublesome laryngitis in which no ulceration is found, and here can be placed many of those cases of iritis which are evidently caused by some focal absorption but for which no focus has been found in tonsils, teeth or elsewhere.

Where tubercles are found in the eye the diagnosis is at once established but in any case of iritis due to a primary tuberculous focus that focus must be discovered, and its activity established before we proceed to treat the eye by specific therapy. This is done by a careful examination of the patient including a more than careful history, and a study of his chest including an *x*-ray which will locate the small area of fibrosis which is the cause of the trouble.

We are now ready to determine the susceptibility of the patient to tuberculin, the amount of activity of the lung focus, and the proper dose for beginning the treatment, all of which are shown by the test injections of tuberculin. L. S. Mace[9] makes the following observations regarding the use of tuberculin.

The choice of a tuberculin is important. It is as essential that our tuberculin be therapeutically potent as that our diagnosis be correct if we are to effect a cure. Old and inactive dilutions of tuberculin residues, emulsions, fat free and toxin free products which have long since lost any resemblance to tuberculin are worse than useless. The author prefers to use the old tuberculin of Koch which is as near being a stable article of definite strength and composition as a biological product can be. The high dilutions should be prepared fresh at frequent intervals, say once a week, but the dilutions down to the third decimal place can be used for a month or two without losing potency.

The first two or three injections of tuberculin are designed to reach the reaction threshold and to indicate the best dose for continued treatment. One one-thousandth of a miligram will usually be sufficient for this purpose. Twenty-four hours after the dose has been given the patient is observed for reactions. These are looked for first at the site of the injection, the so-called local reaction secondly at the lung focus where evidences of moisture may be found that were not heard before and lastly at the iris itself which may be reddened somewhat.

It is not possible to lay down any rules as to the size of the preliminary doses. One must be guided mainly by the severity of eye symptoms; the more serious the eye process appears the smaller the initial dose must be as it is important to avoid all except the mildest reaction in diagnosis and all reactions in continued treatment. It is fair to say that in iritis it is not usually necessary to give a smaller dose than five ten-thousandths of a milligram.

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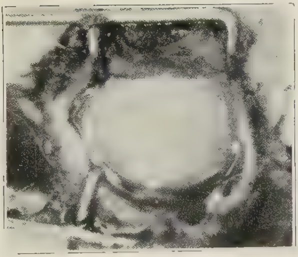
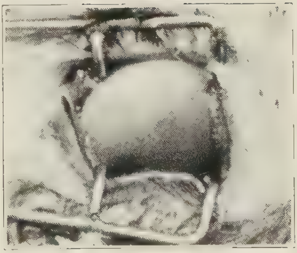
(9) Calif. State Jour. Med., June, 1923.

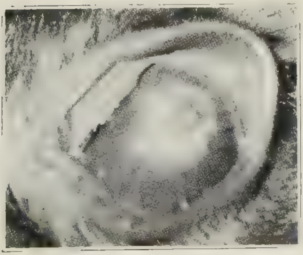
PLATE XXIII.



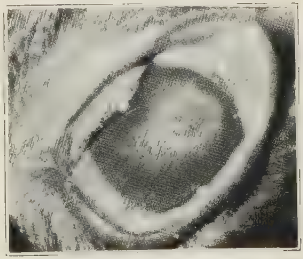
Control animal, day after inoculation of anterior chamber with pneumococci.—Key, page 185.



Sudden involvement, four and one-half days after serum injection, quiet up to that time (pneumococcus inoculation of anterior chamber).—Key, page 185.



Control of infection in injected animal after inoculation of anterior chamber with Staphylococcus aureus.—Key, page 185.



Complete control of infection.—Key, page 185.

When one has found the point at which a reaction appears locally accompanied by a few moist rales at the lung focus and a slight reddening of the eye, one is ready to begin treatment which must continue for several months.

Few methods of treatment in medicine are followed by such brilliant results as the treatment of tuberculous iritis with tuberculin. It goes without saying that the dosage must be correct, neither so large as to give dangerous reactions nor so small as to fail of any effect whatever. It is not possible to say what the dosage should be or how rapidly it is wise to increase it; these questions will be settled in each individual's case and are determined by the reactions and susceptibilities of each patient. One might be justified in saying that a good beginning dose would be half of the one which was found to give a reaction in the first place and that this should be increased as fast as possible without giving reactions of equal severity.

In treating iritis, an apparently local condition, it is easy to fall into the grave error of looking at the iritis as a purely local affair and to lose sight of the true condition of things; that is, tuberculosis is always a general infection and local only so far as some of its many manifestations are concerned. Any one who treats a tuberculous larynx, or a tuberculous ear or a tuberculous eye condition as a local affair only, will not be successful. The disease is a general one. The very condition which we are discussing, viz. tuberculous iritis, is caused by a low grade activity in the primary lung focus. How necessary it is that every attention be given to the general infection, that all rules of regime and diet be observed, for it is only by treating the eye in this broad-minded way that a cure will be obtained. Many patients will be cured by tuberculin alone. That is a matter of luck. In most instances it will be wise to supplement the treatment by the necessary amount of rest and care as to diet and hours of work if it becomes evident that the condition is not clearing up as fast as it should.

To recapitulate. Tuberculosis iritis is a local manifestation of a low grade activity in a primary lung process. This lung process is of a fibroid character, that is, an old, semi-arrested, almost inactive affair. One that is almost healed but not quite. That is to say, the very type of the trouble that responds best to the use of tuberculin. We are not surprised in such cases to see the process clear up like magic when we use tuberculin properly for experience has taught us that in this low grade form of activity tuberculin is the only means we have to cause a complete arrest.

Whatever may be said about the abuse of tuberculin as a therapeutic measure, and there are many who have very much to say on this subject, no one who has seen the effect of this remedy in iritis can have any doubt about its efficacy. In eye tuberculosis as in throat tuberculosis the physician can watch from day to day the effect of his dosage. He can see the reactions and accurately gauge and space his doses accordingly. A proper consideration of the effect of this treatment in this class of cases should convince the most skeptical that in tuberculin we have for a certain type of tuberculosis an invaluable remedy.

Parenteral Injections of Milk in the Therapeutics of Eye Diseases. During the last two years there have appeared numerous articles on the subject of parenteral injections of milk in the therapeutics of eye diseases. Nearly all writers report excellent results, some so good as to make one question the observers' statements and wonder whether he has been carried away by his enthusiasm.

The literature reveals how general has been the use of milk injections in ophthalmology, English, Swedish, German, Italian, French, Egyptian and numerous American writers speak enthusiastically of its benefits.

Most of them refer specifically to the excellent results in iritis and particularly in gonorrheal infections of the eye.

Bargy, an observer at Tonquin, has used milk injections in 3,000 cases, a large percentage of which were complicated by trachoma in some form. He concludes that while milk injections cannot be considered as a panacea in the different diseases of the anterior segment of the eye, yet milk is an extremely valuable aid in suppressing suppuration menacing the cornea, and the method is distinctly prophylactic in conjunctivitis. It is a mode of medication which is simple and an anodyne which may always be tried in severe cases or when it is found that other treatments have had little or no effect. It is of no value in trachoma.

All observers agree that it must be used in conjunction with other treatment. T. W. Moore[1] reports the results of thirty cases treated in this way, some of which were strikingly good, while in two pus cases the method absolutely failed. His technic has been as follows. The patients are put to bed with a light diet. A Wassermann was made in all but the two accident cases. The milk, which is not over twelve hours old, and sweet, is boiled for four minutes and after cooling is injected subcutaneously, either in the scapular region or in the abdomen. Subsequent injections are usually increased 2 c. c. at each injection at forty-eight-hour intervals until four are given. If there are no results, injections are then discontinued.

The author is convinced that in the majority of diseases of the anterior segment of the eyeball milk injections are an addition to our therapy, usually relieving pain and causing a rapid subsidence of symptoms of inflammation. His experience has been altogether with milk of a bacterial count varying from 50,000 to 90,000.

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(1) Southern Med. Jour., February, 1924.

THE FIELD OF VISION

Abnormalities of the Visual Fields. Knowledge of the physiology of vision and its relation to the anatomy of visual pathways has been established on a sound and eminently practical basis. Lesions interrupting different parts of the visual tracts can frequently be localized with almost mathematical accuracy. This can be accomplished, however, only by means of accurate observations, which in turn depend on the use of methods of precision.

Notwithstanding the immense value of visual field examination as an aid to neurologic diagnosis, careful routine work in this line is being done only by a few enthusiasts. In theory, the charting of the visual field is relatively simple, but in clinical practice many difficulties are met, and there are numerous sources of possible error. The more important sources of difficulty and error include: (1) faulty fixation; (2) the lack of alert attention on the part of the patient; (3) incomplete visual defects, such as relative scotomas; (4) low visual function in the periphery of the fields; (5) fatigue—physical, mental or ocular; (6) psychoneurosis; (7) inaccurate technic; (8) faulty illumination, and (9) refractive errors. It is also true that a certain confusion of results has arisen from the variation of methods used. Many forms of apparatus have been devised to facilitate examination, none of which has been entirely satisfactory.

In the evolution of methods of precision for examination of the visual fields, two types of apparatus have been developed; namely, the arc perimeter and the tangent screen. The practical advantages and disadvantages of each may be briefly summarized. The advantages of the perimeter are that (1) the complete extent of normal fields can be tested; (2) the test object is always the same distance from the eye; (3) the size of the units of measurement in all parts of the fields is uniform, and (4) the apparatus is compact and portable. The disadvantages are that (1) the charting of small and irregular defects, especially in the central areas, is difficult; (2) excessive time is consumed in examinations, with resulting fatigue to patient and examiner; (3) there is monocular fixation, and (4) there is a small-scale record. The advantages of the screen are that (1) charting all defects within 40 degrees of the fixation point can be done with facility and accuracy; (2) there is lessening of the time consumed and of the corresponding fatigue; (3) there is binocular fixation, and (4) there is a large-scale record. The disadvantages are that (1) it is not applicable for examination of the extremes of the peripheral field; (2) it is cumbersome; and (3) there is varying size to a degree of the visual angle as projected on different parts of the tangent screen.

Different modifications of apparatus and variations in methods of examination have been tried by many workers. An important modification of the screen, called a stereocampimeter, was devised by Lloyd. He employs a small screen and the utilization of a new principle, that of binocular fixation. A partition separates the two fields of vision, and a combination of prisms and magnifying lenses familiar in the common stereoscope secures the binocular fusion of two fixation points on the screen. This apparatus had the advantage of holding the attention and securing better fixation but it is serviceable for only a relatively small portion of the visual fields. The recording is visible to the patient during the examination, and, to obtain a permanent chart, the record must be transferred later from the slate to a chart.

Accuracy depends largely on five fundamental requirements: (1) the maintenance of binocular fixation; (2) the practical elimination of fatigue; (3) uniform illumination; (4) a large field for the recording of observations, and (5) invisibility of the record to the patient during examination. In addition to these requirements, it is desirable that the apparatus be portable, and that permanent records be secured quickly and easily.

Believing it possible to combine many of the good principles in a single apparatus, S. D. Ingham and T. C. Lyster[2] have devised a screen, the curtain of which is made of gray cotton cloth measuring 120 by 180 cm., mounted on a take-down frame or stand by eyelets slipping over projecting screw heads so that it can be quickly attached and removed. A fresh screen is used for each examination. A vertical triangular partition, perpendicular to the screen, separates the fields of the two eyes. A chin rest steadies the head of the patient, with the eyes 55 cm. from the center of the screen and the glabella touching the partition. Two fixation points are attached to the screen, 5 cm. on each side of the partition, and 10 cm. from each other. Steroscopic vision is obtained by the use of prisms with the bases outward, and they are rotated, if necessary, to obtain fusion of the fixation points. The visual field of each eye is thus unrestricted, except to the nasal side, where it is limited to 5 degrees from the fixation point. Although it is impossible to examine the nasal fields by using binocular fixation, this can be accomplished by removing the partition and covering the eye not being examined. The fields are plotted with chalk on the reverse side of the screen, invisible to the patient. The translucence of the cloth makes it possible to see clearly the shadow of the test object at all times from the reverse side of the screen.

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(2) Jour. Amer. Med. Ass'n., Jan. 5, 1924.

When finished, the chart is photographed for permanent record. The fields of both eyes can be charted on one screen, or a fresh curtain may be used for each eye to obviate possible confusion in reading the charts. After washing, the curtains are ready for further use.

In routine practice, the patient is placed with the eyes 55 cm. from the screen. At this distance, clear vision is obtained with little effort of accommodation. The field is large enough for reasonably accurate charting, and, within the 20 degree circle, 1 degree of the visual angle is approximately represented by 1 cm. on the screen (10 degrees equal 9.7 cm.; 20 degrees equal 20 cm.). For accurate estimations, a scale has been made, marking the varying distances of the screen representing intervals of 10 degrees of the visual angle. Thirty degrees equals 31.75 cm., and 40 degrees is 46.20 cm. from the fixation point.

The authors have endeavored to increase the accuracy of the Bjerrum screen by applying stereoscopic vision when possible, and by making the record visible to the patient. The other features are attempts to simplify permanent records, shorten the time and lessen the trouble.

The neurologist is impressed by the analogies that exist between examinations of cutaneous sensibility and of retinal sensibility. Anesthesias, hypothesias, hyperesthesias and sensory dissociations have their parallels in absolute or complete scotomas, relative or incomplete scotomas, the loss of color discrimination or color scotomas, and photophobias. In all examinations for the determination of sensory impressions, the cooperation of the subject examined is a prime requisite. Attention and response are necessary and these activities vary in different patients from zero to a high degree of alertness and promptitude. Variations are common in results of separate examinations of individuals, and even during a single examination apparently inconsistent responses are frequent. Conclusions must often be drawn with a large concession to the theory of relativity.

A visual field chart is a map of the area visible to the patient made with the eye under examination in a fixed position. It is the projection on a surface of subjective visual perception, and varies not only with the organic lesions of the visual apparatus, but also with the functional and psychologic condition of the patient. For neurologic diagnosis, it is desirable that the visual chart should furnish (1) an outline of the full field of vision obtained with a large object; (2) the extent of areas in which small, white and standard colored objects are recognized; (3) an outline of the blind spot; and (4) the outline of any scotomas.

Interpretations of defective fields must consider the method and conditions of the examination, discount the possible margin of error, and explain the defect.

Lesions posterior to the optic chiasm produce defects in the visual fields of both eyes which are approximately symmetrical. When the visual defect is incomplete, the degree of disturbance is equal in the corresponding parts of the homonymous fields. This holds true for organic lesions, whether the resulting defects are hemianopia, quandrantanopia, paracentral scotomas or irregular cuts into the visual fields. This symmetry of defects is remarkable and is maintained whether one or both of the visual tracts are impaired, and without regard to the location of the lesion along the postchiasmal visual pathway.

The complete interruption of one visual pathway causes complete homonymous hemianopia. In this condition, fixation and approximately normal central vision always remain, but the blind area extends to within a fraction of a degree of the fixation point. This condition can best be demonstrated on the screen at a relatively long distance from the patient, utilizing binocular fixation and assuming good cooperation on the part of the patient. The old conception of a wide, double innervation of the macular area was an error, probably to be explained by faulty fixation and a lack of precision in making tests.

It is generally considered that the typical visual defect of lesions of the optic chiasm is bitemporal hemianopia; but, like many "typical" conditions, it is not always found in perfect form. The bitemporal character of the defects is often entirely lacking, and homonymous hemianopia is not an uncommon result of lesions near the chiasm. As a point of practical importance, it has been emphasized that field defects caused by lesions posterior to the optic chiasm are characterized by an essential symmetry of defect in the homonymous fields of both eyes. Homonymous defects caused by lesions involving the optic chiasm, however, are characterized by the absence of such symmetry. The field of one eye invariably suffers more than that of the other, and the outlines differ in contour. It may be said that lesions in the region of the chiasm give rise to a wider range of visual field defects than lesions of any other portion of the visual apparatus.

NEW INSTRUMENTS.

Ophthalmic Column for Oculists. A convenient unit has been devised by G. S. Crampton[3] which enables the ophthalmologist to have within his reach most of the equipment necessary for refraction, treatment and minor operations, including means of darkening the consulting room so as to obviate the need of having the patient leave his chair to go to a dark room.

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An octagonal cast iron column supports an extension arm, which carries the trial case, which can be moved to any position within a radius of four feet about the

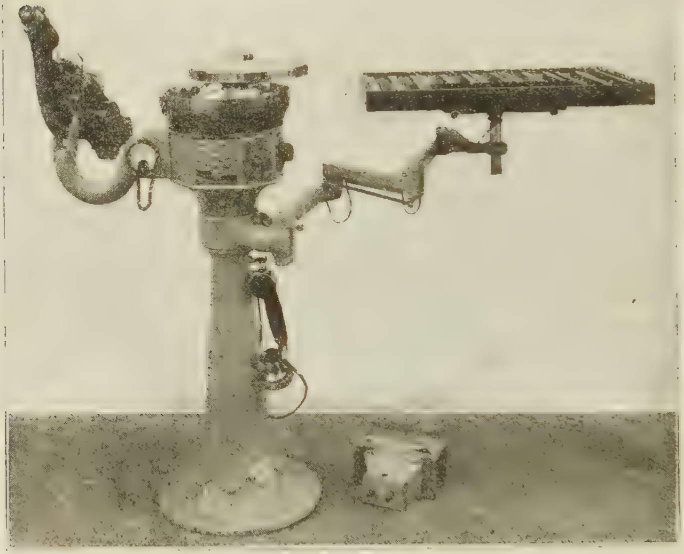

Fig. 4.—An ophthalmic column for the consulting room. (Crampton.)

column, such as beside the patient for refraction, a meter or so in front for retinoscopy, or entirely out of the way during ophthalmoscopy. During retinoscopy the trial case is illuminated.

At the top of the column there is a bronze receptacle carrying eighteen special dropper bottles and solution holders, as well as receptacles for clean and waste cotton, applicators, wash bottle, etc. A nine-inch disc of heavy white glass, in an aluminum frame, forms a cover which can be swung to one side as a support for instruments during an operation.

The bronze treatment compartment rests upon an octagonal expansion of the column, which carries the various controlling switches and other conveniences including three small metal drawers for instruments, an electric steam sterilizer which can be detached when not in use, and a low voltage rheostat for diagnostic instruments.

There are switches for muscle and room lights and for the visual acuity cabinet, the illumination of which is under rheostat and voltmeter control. A special switch operates a mechanism in the acuity cabinet by means of which any desired line or character may be brought into view.

The window shades of the room are automatically controlled by a switch on the column and a motor mechanism at the window, by means of which the shades are raised and lowered to a predetermined height. One movement of the switch darkens the room while a reversal raises the shades.

Another convenient attachment is the one-hand telephone which may connect with the secretary's desk in the waiting room, or with central.

The column was shown with a lensometer attached but this is not considered as standard equipment.

Muscle "Folder" for Strabismus. A muscle "folder" for the correction of strabismus was demonstrated by J. W. Calkins[4] before the section of ophthalmology of the American Medical Association last year. The advantages claimed for this method of muscle shortening for strabismus are simplicity of instrument and of technic, a method of graduating the length of muscle taken up, and a manner of putting in of sutures which makes cutting through or slipping of sutures almost impossible.

The instrument is shown in Figs. 5 and 6. The looped, hairpin-like portion of the "folder" is of very rigid steel, adjustable in length so as to fit about the muscle, and fits snugly into two holes in the handle of the

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(4) Amer. Jour. Ophth., November, 1923.

"folder." This prevents the two prongs (hairpin-like part) of loop from bending or twisting as the muscle is being "folded."

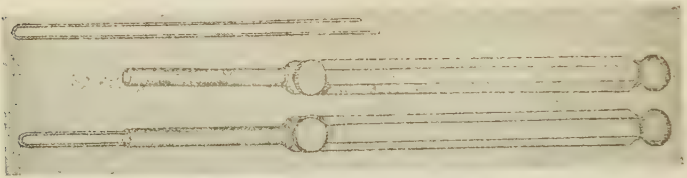


Fig. 5.—Folder in detail, parts separated above to slip loop over tendon and brought together below.

The steps of operation are shown in Plates XXIV and XXV. The muscle is exposed by a longitudinal or vertical conjunctival incision. After freely separating the muscle on all sides, the hairpin like part or "folder" is placed about the muscle with one prong behind and the other prong in front of the muscle. The handle is then attached. The "folder" is then shifted until the prongs are midway between the insertion of muscle and that part of muscle as far back from the insertion as is thought necessary to obtain the desired shortening. Keeping the

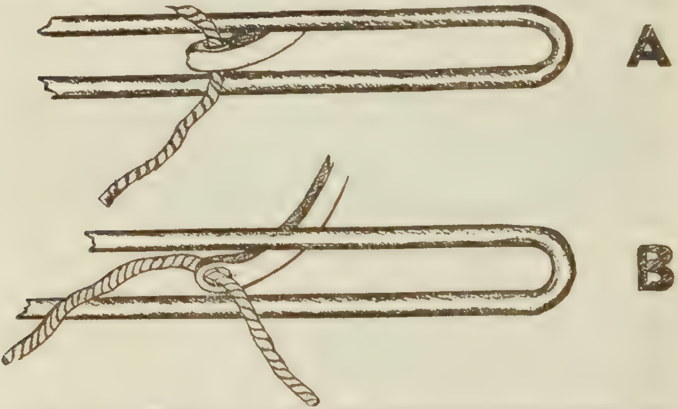
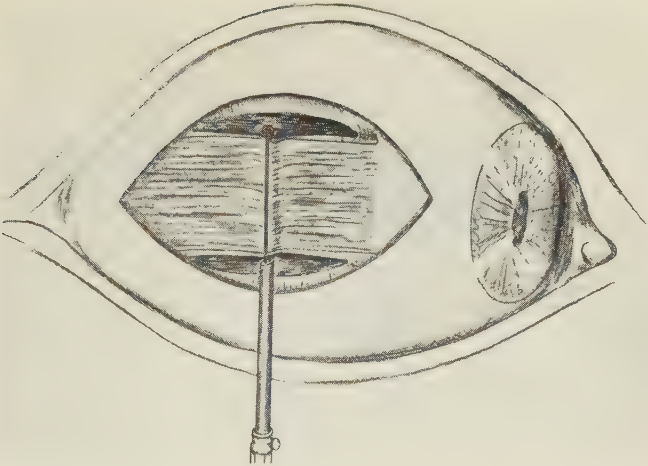
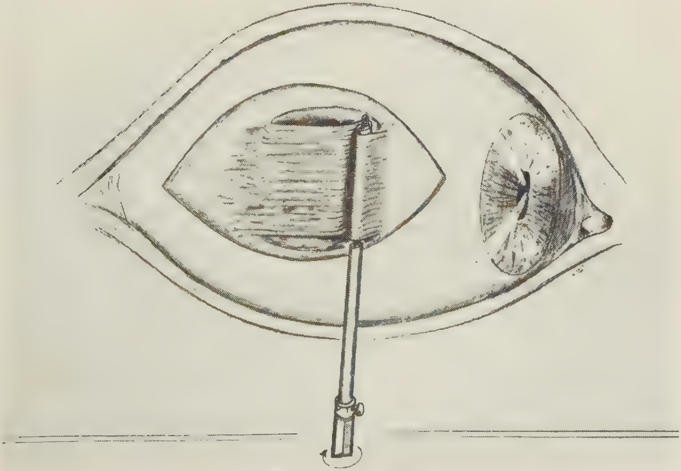


Fig. 6.—A—Ordinary needle with eye in plane of curve. B—Special form preferred, eye at right angles to curve.

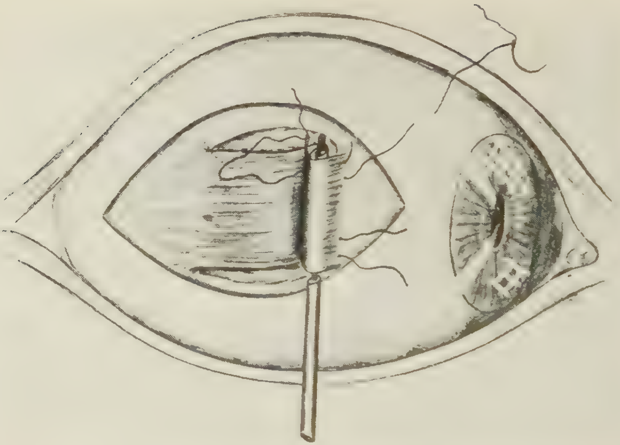


Loop slipped over tendon and handle applied.—Calkins, page 203.

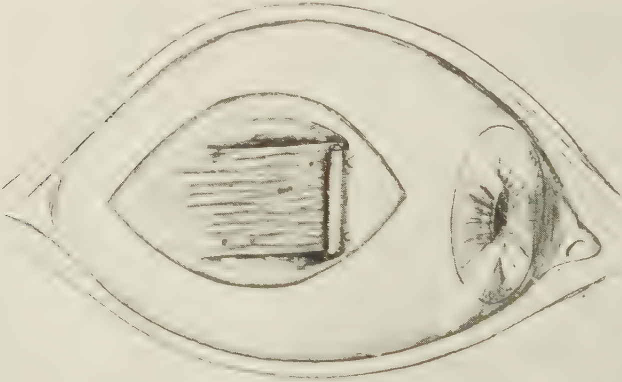


Tendon folded by twisting loop.—Calkins, page 203.

PLATE XXV.



Introduction of sutures through folds of tendon.—Calkins, page 203.



Tendon folded and instrument withdrawn.—Calkins, page 203.

prongs always at right angles to the muscle fibers, the handle of the "folder" is then rotated so that the outer prong moves *away from* the muscle insertion and the prong beneath the muscle moves *towards* the muscle insertion.

As many half-turns of the handle can be made as is necessary to overcorrect the squint slightly. The amount of tension used as the muscle is being "folded" is very readily sensed by the fingers holding the handle of the instrument, and therefore there is no danger of using too much force, thus tearing or otherwise injuring the muscle fibers. After rotating the handle of the "folder," as described above, one, two, three or more half-turns, to overcorrect the squint slightly, the assistant holds the instrument with one prong anteriorly and the other prong posteriorly and the prong at right angles to muscle fibers. Two double-armed sutures are used with a special muscle insertion, between the prongs of "folder," coming out well into the tendinous muscle insertion. Two mattress sutures are used and should include more of the central portion of the muscle than is shown in the plates. Passing the needle between the prongs of the loop makes this step of operation very easy, with no danger of passing the needle too deeply, and insures a very accurate placing of the sutures. Only loosely tie a single knot in each suture, and then remove the instrument entirely. Then tighten this knot and tie the second half of knot. Cut ends of sutures off short. Close conjunctiva with silk or gut or kangaroo tendon.

Fig. 7 is a diagram showing the number of half-turns of "folder" necessary to take up a given length of muscle. This is only approximate. This diagram also shows how the suture pierces the muscle several times, thus locking the folds together.

The disadvantages of this method are difficulty in using the "folder" on the internal rectus muscle and a possibility of leaving a "bunch" of tissue at the site of operation. In a limited use of the instrument in squint cases and upon the cadaver, the first difficulty has been overcome by having the handle of the instrument above instead of below the eye; and, so far, no tumor has remained at site of operation.

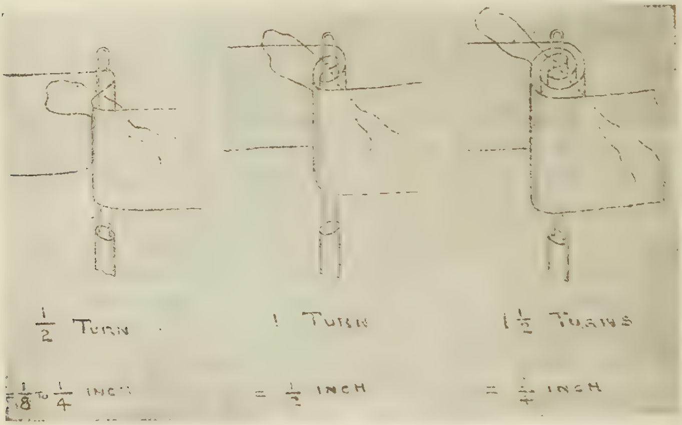


Fig. 7.—Showing approximate effect of different numbers at half turn and how sutures lock the folds together.

A Lacrimal Needle and Punctum Dilator Combined. A combined lacrimal needle and punctum dilator has been devised by A. S. Tenner[5].

It has a small, solid tip with a lateral fenestration 1.5 mm. back of the tip. It is conical, increasing in diameter from about 22 gage at the tip to about 17 gage at the base. It is without any curve, and is about 2 cm. long. The material is sterling silver and is not affected by silver salts or iodin.

The hub has the regular standard Luer slip and can be used, therefore, with a Luer syringe of any size. It is advantageous, however, to use a well made syringe of domestic manufacture, such as a B-D Luer, for the reason that the imported syringes fit poorly, resulting either in leakage or in the needle's flying off during pressure.

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(5) Jour. Amer. Med. Ass'n., July 5, 1924.

The advantage of the small rounded tip is obvious. By its means the needle can enter any punctum lacrimale, no matter how small. As it passes along the canaliculus, its diameter increases on account of its conical shape, and, consequently, it not only dilates the punctum but fits it so snugly that there can be no return flow.

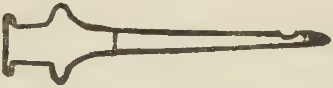

Fig. 8.—Lacrimal needle and punctium dilator.

By means of the needle, one can dispense with the use of a punctum dilator in all cases except those in which the passage of large sounds is indicated.

The Ear

ALBERT H. ANDREWS, M. D.

THE EAR.

HEARING AND DEAFNESS.

Problems in Relation to the Hard-of-Hearing. In discussing problems relating to the hard-of-hearing H. Newhart[6] states that a conservative estimate, based upon various sources, including statistics furnished by medical examinations in our public schools and the examinations of drafted men, discloses the fact that we have in the United States upwards of three million individuals of all ages whose hearing acuity has been so reduced as to prove a handicap in their educational progress, in their economic efficiency and in their capacity to enjoy normal social contact with their fellows.

It is conceded that by far the greater number of cases of deafness are preventable. Thus the situation, involving so large a number whose condition is practically as unfortunate as that of the blind, challenges the skill, active interest and intelligent efforts, not only of the otologist, but of the physician, the educator and the social service worker.

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(6) Minn. Med., June, 1924.

It is the writer's opinion that the fundamental need in the prevention of acquired deafness lies in a more thorough training of the medical student in this branch of medicine, whereby he would be better equipped to recognize and successfully treat those diseases which lead to impaired hearing. This demands that more time be devoted to this subject in our medical schools than is now accorded it. Properly equipped so as to be sufficiently skilled and interested in diseases of the ear, the general practitioner would be able to render as good service in this field as he gives in general surgery or internal medicine. That he is not adequately equipped is attested by his evident lack of enthusiastic interest in otology and by the impressive number of our failures to prevent avoidable cases of defective hearing. It should never be forgotten that the majority of patients are not in the habit of consulting a specially trained otologist for the seemingly insignificant maladies which so often lead in time to irreparable loss of hearing. In this matter, however, the public should be educated by the family physician to neglect no ear symptom or any diseased condition of the upper respiratory tract which might affect the hearing.

Other important points in the prevention of deafness are: (1) the regular routine examination at frequent intervals of all individuals as to the acuity of their hearing and (2) the earliest possible removal of all discoverable pathological factors which might cause ear disease. Children of school age in our cities, to a large extent, receive this attention, but the benefits of such examinations and treatments must be extended to individuals of all ages and in all communities.

Any physician who arbitrarily advises a patient who is hard of hearing that nothing can be done to help his condition, without having himself made a careful otological examination or having had such examination made by a competent otologist, commits an act of gross unfairness to the afflicted party and discredits the ideals and skill of other members of his chosen profession. Yet, today we see among the hard-of-hearing numerous examples of almost criminal neglect on the part of parents, of the patients themselves or of their previous medical advisors. This neglect is rarely intentional, but is rather the result of ignorance; yet the consequences to the patient are none the less disastrous.

Our most helpful resource in solving the problems of those who are already materially deafened is found in lip reading. Too much cannot be said in favor of this boon to the hard-of-hearing. As the blind substitute hearing and the sense of touch for sight, so the deaf, with a mind trained to alertness and application, can substitute the sight for hearing. The accomplishments of the skilled lip reader in the understanding of spoken language are truly marvelous. It is very important that all those whose impairment of hearing requires any considerable effort to understand the conversational voice should be urged to begin lip reading at once in order to compensate for the diminishing acuity.

While lip reading can not be acquired with equal proficiency by all, nor does it prove always infallible, and can not be depended upon in all business relations, it does more than any other measure to mitigate the sense of isolation of the deafened and improve his outlook upon life. Every one with good vision can become more or less proficient in the art, and good results are obtained by many in three or four months of close application. Others require more time. The highest degree of skill can only be attained by years of training.

Methods of Detecting Alleged Deafness of One Ear. The Stenger test for the detection of pretended total unilateral deafness is described by R. Sonnenschein(7) as follows: It is a well known fact that when the ears are exposed simultaneously to two sounds of the same pitch and intensity the one that is produced closer to one ear throws out or drowns out, so to speak, the sound that is entering the other ear. In other words, if a sound is produced at a certain distance from one ear, the individual cannot know whether at the other ear there is also a sound being produced at greater distance and therefore apparently of less intensity than in the other ear. This fact has been taken advantage of in the well known Stenger test. It is essential that a pair of forks be employed of exactly the same pitch, and also that the patient does not know that two forks are being used at the same time. For this reason the individual is usually blindfolded.

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(7) Ann. Otol., Rhinol., and Laryngol., June, 1924.

Most often a pair of the Bezold (435 double vibrations) *a* forks are selected. Having struck both forks, one of them is held at a certain distance, for instance, ten inches, from the left ear. In the normal individual, if then a fork of the same pitch is placed five inches from the opposite ear, he will hear it only in the ear from which the fork is at a shorter distance, because the sound entering the ear from a distance of five inches drowns out the sound entering the other ear from a distance of ten inches. While the intensity of sound varies inversely as the square of the distance (in an open, unconfined space), it does not follow that rule exactly in closed rooms, due to differences in reflection from walls, etc., as well as the varying standing wave systems produced in the air. If the patient pretends his right ear is deaf, test the left or well ear and find out the distance at which the fork will be heard—e. g., ten inches. In the right ear, which is said to be deaf, the individual will of course deny hearing all sounds, no matter how close the fork is approached to that ear. He hears it but denies having any perception of the sound.

With one fork kept vibrating, let us say, four inches from the right ear, and the other fork approached to within six inches of the left ear, the patient will say that he does not hear any sound at all, even though he previously admitted hearing the fork with the well (left) ear at a distance of ten inches. The reason is this. The fork near the right ear will drown out the sound of the fork held six inches from the left ear. In view of the fact that he claims to be deaf in the right ear, he will say he hears nothing at all, whereas, if he really were deaf in the right ear he would hear the tuning fork vibrating in the vicinity of the left or well ear. W. A. Wells of Washington has lately described a modification of this test which is very ingenious. He uses a piece of rubber tubing of one-fourth inch caliber, thirty inches in length and of a firmness to give a good conduction of sound. In one end of the tube is an earpiece which fits well into the auditory meatus, while in the other end is inserted the stem of a long sounding fork of low pitch (about 120 vibrations a second). Applied in the ear in the case of a malingerer, the value of the test lies in the fact that with the intensified sounds in the alleged deaf ear one is deprived of the power of recognizing the weaker sound in the good ear, which is not true in a real deafness. While the earpiece is in the supposed deaf ear, the vibrating fork is conducted stealthily to the meatus of the opposite ear, not too near, but to a point at which it has been previously ascertained that he could distinctly hear it; the really deaf person will report hearing the fork as soon as it comes into the range of hearing of the good ear. The malingerer, unconscious of any hearing in his good ear because of the lateralization of the sound to the alleged deaf ear, the side of the greater intensity, continues to report no hearing, and this gives incontestable proof of willful simulation.

Eustachian Injection in Treatment of Catarrhal Deafness. In the treatment of catarrhal deafness E. D. Watkins[8] injects camphor and menthol through the eustachian tube into the middle ear.

Local anesthesia is obtained by passing applicators with cotton thereon, soaked in a solution made by mixing equal volumes of 4 per cent novocain and adrenalin chloride solution 1 to 1,000, through the nasal cavity to the region of the tube orifice.

Two of these through each side is sufficient. Since adopting this method he has had much less trouble with patients fainting, and he believes that the anesthesia is as good as that obtained by using stronger anesthetics.

The catheter having been successfully maneuvered into the tube opening, he injects with a medicine dropper as much of an oily solution of menthol as possible into the catheter and then inflates with the Politzer bag applied directly into the catheter. This undoubtedly medicates the tube as well as inflates it, and medicates the middle ear space. This procedure is carried out two or three times a week.

Instrument for Making and Recording Hearing Tests. A new device for testing the hearing, described by H. Clay Mitchie[9], is called the audiometer instrument because of a permanent charting of the hearing in 8 different pitches. It is a vacuum tube oscillator, equipped with controls for regulating the pitch and intensity of the sound. The accuracy and simplicity of the instrument are its principal recommendations.

Methods and Interpretation of Fundamental Tests of Hearing. R. Sonnenschein[1] says much can be learned regarding the state of the individual's hearing by an observation of the patient before any other tests are undertaken. The pitch of the voice helps us in dif-

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(8) Jour. Tennessee Med. Ass'n., September, 1923.

(9) Mil. Surgeon, July, 1924.

(1) Ann. Otol., Rhinol., and Laryngol., June, 1924.

ferentiating between impairment of the conduction and perception apparatuses. When there is marked middle ear deafness, as, for instance, in an otosclerosis or a chronic tubal catarrh, the patient has an autophonia—that is to say, his own voice sounds very loud to him. He thinks it also appears very loud to the environment, and he therefore has a tendency to speak very low. On the other hand, when there is a marked involvement of the perception apparatus, the bone conduction is very materially diminished and the patient's own voice sounds very weak to him. In order to make others understand him, he is likely to speak very loud.

In using the voice to test the hearing acuity the unaccentuated whisper and unaccentuated conversation are employed. It is important not to accentuate; otherwise, the sound is carried further, and it is more difficult to get an accurate estimate of the patient's ability to hear. For this reason it is better to speak with the residual air, placing no emphasis upon any particular sound or syllable. With one ear tightly occluded, either with a wet finger, cotton or noise apparatus, with the eyes closed or averted so that the patient is unable to see or read the lips of the examiner, approach the patient gradually and note the distance at which the numbers, words, etc., are properly repeated. Patient must not touch wall, door, etc., as they conduct the sounds via bones of arms, etc. Use high pitched and low pitched sounds individually, or numbers combining the two, as for instance "forty-seven," which includes both a low and a high pitched sound. Note the distance at which the low or high or both were heard, It is very important to approach the patient from a distance when examining the patient with a watch, with voice or with other instruments, and to note the distance of hearing. One should not produce the sound close to the patient and then step away from him, because it is a psychologic fact that as we recede, he will from memory often continue to say that he still hears a certain sound when he no longer does. If he is approached from a distance, a much more accurate estimate is had.

Classification of Deafness. From a clinical standpoint, M. A. Goldstein[2] classifies deafness as follows:

1. Lymphatic diathesis with hypertrophied tonsils, adenoids in the naso-pharynx, lymphoid nodules throughout the upper respiratory tract, pale and soft Schneiderian membranes with tendencies to frequent and various aerobic infections whereby a mechanical blockade of a more or less permanent character is developed in the tubo-tympanic tract, tissue metabolism changed and the functions of the conducting apparatus of the ear impaired.

Functional tests usually corroborate the clinical diagnosis of impairment of the sound-conducting mechanism.

With the better comprehension of the pathology and surgery of Waldeyer's lymphatic ring, much of the evil aftermath in this group has been held in abeyance. Prompt intervention not only removes mechanical obstruction to ventilation and sound-conduction, but also prevents the more serious adhesions, retractions, contractions and absorptions in the tympanic and tubo-tympanic areas where severe and permanent deafness may ensue.

2. As most of the exanthemata have their focal infection in a specific angina and as the local invasion so frequently includes the ear tract, we have a ready accounting for the frequency with which suppurative processes invade the tympanic cavity in this group. These suppurations seem to be of a specially destructive type, for the membrana tympani is often sloughed in a large radius, the ossicles necrosed and the walls of the tympanic cavity eroded. Similar erosions are

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(2) Laryngoscope, September, 1923.

found about the fenestrea ovali and rotundae and these lead to permanent ankylosis or bony changes in this part of the labyrinthine wall.

It is a significant fact that many children with total deafness date their misfortune from an intense invasion of an exanthematous fever. Close observers have concluded that such invasions carry with them not only a destructive process centered in the tympanic cavity, but a toxic, selective attack on either a part of the labyrinthine structures, ramus cochlearis, or localized meningitis.

Careful functional tests in this group reveal impairment of both low and high ends of the cochlear scale and often simulate the clinical tests of oto-sclerosis. There is this difference, however, between an incipient oto-sclerosis and an exanthematous invasion of the labyrinth. In oto-sclerosis the basilar and apical Corti cells are involved and a large part of the central scale still functions; in some types of exanthematous invasion of the labyrinth the cochlear cells may be intermittently and irregularly attacked, producing definitely recognized and still functioning tone-islands throughout the cochlear scale.

3. In epidemic meningitis, poliomyelitis and exanthemata with intense febrile reaction, we frequently find a sudden attack on the auditory central organ and total deafness. The following brief clinical report will illustrate. An intelligent, normal girl of sixteen was attacked Christmas day by epidemic meningitis with all of the characteristic symptoms of this infection; was seriously ill for a week, joined family at dinner New Year's day, recovered from meningitis, but totally deaf. Here again we note a selective localized meningeal attack on the nerve trunk.

Functional tests with all forms of sound-producing apparatus, including tuning forks, voice, musical instruments and gongs failed to produce any sound impression. Even if the labyrinth end-organ has escaped attack, if both auditory nerves in their trunk have been toxically invaded and destroyed, the deafness must be complete.

4. Much has been written about oto-sclerosis, but we are still undecided as to its pathological entity. It occurs less frequently in the child and the youth than in adult life, and the ensuing deafness is gradual in character, hence its popular term, "progressive" deafness. Heredity is an important factor in this type.

There are several clinical and pathological data which seem fairly constant in this group. We have every reason to believe that a spongifying or sclerotic change in the labyrinthine capsule takes place; the point of most frequent attack seems to be about the foot-plate of the stapes; the membrana tympani frequently shows no change in plane or lustre other than a circumscribed pink spot at the promontory; the tuning-fork and Galton whistle give evidence of a diminished perception for both low and high tones; bone conduction is prolonged beyond the normal and a paracusis is usually present in incipient cases.

5. One of the most serious factors in the production of profound deafness is that of congenital transmission. Interesting statistics have been compiled showing the large percentage of total deafness evolved from the matings of the congenitally deaf and consanguinous marriages. We are here concerned not with a pathological but with a biological question. At a former meeting of the American Otological Society, Goldstein showed among a series of microscopic sections of the labyrinth, one of a congenitally, totally deaf child. The most interesting phase of this specimen was that the cochlear nerve in the labyrinth was shown to consist of only a nerve substance; the nerve presented the appearance of an empty shaft. Or, we may find a congenital atresia or absence of the external ear or of the tympanic cavity or its contents and a consequent undeveloped hearing mechanism. These

brief descriptions illustrate the point of a biological absence of tissue rather than a pathological destruction or degeneration.

A functional test with tuning-forks and other sound-producing apparatus in this group elicits no response to any sound-perception, for if the cochlear or peripheral element is absent, no sensory impression can be conveyed to the cortical centrum according to our present interpretation of the theories of audition.

6. We should distinguish between the congenital type in which a transmissable absence of a part of the auditory nerve mechanism may be found and the hereditary transmission of a degenerative element as in rickets or syphilis. In syphilis the cochlear nerve or the ramus cochlearis may be present, but may have undergone sufficient degeneration in embryo or in early childhood to present a decided pathological entity.

Functionally such a differentiation could perhaps not be made by sound tests. Here we might avail ourselves of the Wassermann reaction, preferring spinal puncture to blood examination, and it is not unreasonable to hope, if such laboratory findings corroborate a syphilitic diagnosis, that an anti-syphilitic treatment may, even in cases of profound deafness, produce improvement in hearing.

7. Impaired hearing caused by recurrent coryza, deflected septum, hypertrophied turbinates, polypi (mucous or fibrous), adenoids, tonsils, malformation of the palate and choanae, chronic suppurative otitis media, large perforations of the membrana tympani, etc., where the mechanical influence of obstruction have not developed permanent secondary pathology, such as adhesions, obstructions in the tube, necroses of the ossicles, partial destruction of the tympanic walls, may be classified as a separate group where the

necessary surgical and therapeutic treatment may greatly improve the hearing and restore practical auditory usefulness.

Endocrine Dysfunction as a Possible Etiologic Factor in Progressive Deafness. Endocrine dysfunction as a possible etiologic factor in progressive deafness is suggested by D. W. Drury[3]. After reviewing the various theories regarding the cause of progressive deafness he remarks that the endocrine glands offer a field of study of definite possibility. In the first place, certain of them are believed to have some influence over the calcium metabolism which may be causative or resultant. Further, they are recognized as very definitely concerned in general metabolism as regulators if not centers of control. In oto-sclerosis, there exists the possibility that the absorption of any portion of the margin of the oval window might interfere with the nutrient supply of that part of the annular ligament of the stapes contiguous to it. This might engender an absorption of the ligament itself with a gradual replacement by porous bony elements which in turn could become more compact in structure. Granted that this is speculative, an endocrine influence might well initiate, supplement or modify such changes.

Deafness and its Prevention. In discussing perception deafness, W. T. Patton[4] mentions two theories as to etiology which have divided otologists into two camps. First, those who have believed in the theory of negative pressure and, second, those who have believed in infection as the primary cause. Andrews claims that all deafness is the result of a deep infection in the lymphoid tissues, that the infection then exists as a chronic focus, subject to acute exacerbation, that the resulting deafness does not occur from extension by continuity of the infected tissue through the

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(3) Boston Med. and Surg. Jour., June 12, 1924.
(4) New Orleans Med. and Surg. Jour., February, 1924.

tubes and middle ear, so much as it is the result of the toxin acting on the perception apparatus; that is, we have perception deafness from the beginning, without regard to tissue action in the middle ear. Lymphoid tissue predominates until adolescence and then is replaced by fibrous and mucoid elements, which are much more susceptible to infection. The next class of cases follows infectious diseases, which in many instances, result in chronic foci, subject to acute exacerbation throughout life. Foci of infection may lay dormant for years in teeth, tonsils or other membranes of Waldeyer's ring, sinuses, lymph glands, etc., and only after some sickness, as influenza, measles, diphtheria, etc., does the patient develop a progressive deafness. Why this infection takes place in a particular joint, in the endocardium or middle ear, we do not know, but once having occurred, the tissue reactions go on in the same organ indefinitely. In all cases where there is a functional disturbance of the perception apparatus and in the organ of hearing, as in other organs, the restoration of function is dependent on whether its special nerve mechanism is irreparably damaged or only functionally disturbed. The mouth, nose and lymphoid tissue continually harbor a number of bacteria. These patients have low resistance and overwork is as potent in activating the focal process as is exposure; this being the case, it is believed that the deafness is a manifestation of the systemic infection resulting from a special strain of bacteria; the toxin acts on the perception apparatus from the beginning and continues to act until the terminal stage of marked perception deafness on nerve degeneration is reached; the accompanying gross tissue changes in the conduction apparatus plays but a minor rôle in the deafness.

He also states that there are at least ten different theories as to the cause of oto-sclerosis. Brude gives authorities for syphilis, arterio-sclerosis, chills, internal secrection changes, latent tetany, rheumatism and gout, uremic intoxication, scrofula, anemia, rickets, osteomelacia, auto-intoxication, tuberculosis, tropho-neurosis, and wasting diseases. The hereditary nature is most marked, as with bony abnormalities and some bone diseases. Moons and Politzer gave reasons for considering it a primary disease of the bony labyrinth; the mucous membrane in their cases was found perfectly normal. Mayer now considers it an undescribed variety of otitis-fibrosa and osteifibromatosis. Ferreri says, there seems a "great affinity" between osteomalacia, rickets and oto-sclerosis; therefore the treatment by phosphorous, cod-liver oil and gland therapy. Sieberman regards it as an over development in the labyrinth of cartilage remnants, which normally are there at least until adult life, especially in the region in front of and above the oval window.

Deafness in Late Congenital Syphilis. In a series of 230 cases of congenital syphilis examined by A. Keidel and J. E. Kemp[5], 22 cases of deafness were found.

This type of deafness is characterized by an onset which may be gradual or abrupt. The patients are usually at or about the age of puberty when the deafness first appears and in most instances they present other unmistakable manifestations or stigmata of congenital syphilis. An antecedent interstitial keratitis is frequently noted in the anamnesis. Deafness may be complete or partial, but is always bilateral, although one ear is often affected to a greater degree than the other. Equilibration is rarely disturbed, and vomiting is unusual, although at the onset there may be tinnitus and occasionally nausea. The entire process may be a painless one.

A study of the race and sex of cases shows that in this clinic negro males are the most susceptible. In the order of susceptibility the negro male (12.5 per cent.) is followed by the white male (10.6 per cent.),

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(5) Southern Med. Jour., September, 1923.

the negro female (9.6 per cent.) and the white female (7.5 per cent.). The incidence for the negroes of both sexes (10.7 per cent.) is higher than that of the whites (8.8 per cent.), and that of the males of both races (11.2 per cent.) is higher than that of the females (8.3 per cent.). In these figures they disagree sharply with practically all other writers on this subject, particularly in that they find the susceptibility of males to be higher than the females. Their 22 cases are divided equally between males and females, but in the whole group of congenitally syphilitic individuals there are four females for every three males.

Tinnitus was present in five of the eleven patients in whom the presence or absence of this symptom was noted, and is apparently more often associated with a rapid onset. It may disappear spontaneously, but there is no rule as to its duration. In one case it disappeared under anti-syphilitic treatment, but recurred after a lapse of treatment. Vertigo was encountered only four times, among ten patients, but in only one was it sufficiently severe to disturb equilibration. Vomiting had occurred in only two patients and was a prominent symptom in only one of these.

In the physical examinations, signs of congenital syphilis other than the ear disturbance were noted in 91 per cent of the patients.

After the process is once established, treatment is of little avail and the prognosis is bad. If the patients are seen early before there is marked impairment of nervous function, further loss of function may be prevented. These patients, however, furnish a powerful argument in favor of the early, vigorous and sustained treatment of all congenitally syphilitic children, particularly those that survive the first year of life.

Summary: Twenty-two cases of deafness due to late congenital syphilis are reported. The incidence of this form of deafness is approximately 10 per cent. Males are more susceptible, particularly negro males.

The age of onset approximates that of puberty. The onset may be sudden or gradual and is usually accompanied by tinnitus and vertigo. The symptom complex is characteristic. Active manifestations of congenital syphilis other than aural lesions co-exist with or antedate the malady and are often of unusual severity. Of these interstital keratitis is the most common. The blood Wassermann test is positive in 90 per cent. of the patients, and spinal fluid studies were invariably negative for abnormalities due to cerebro-spinal syphilis. Cranial nerves other than the branches of the eighth are rarely involved. The prognosis is not good, and the results of treatment are poor. Adequate treatment of all patients with early congenital syphilis is advocated as a prophylaxis for late aural involvement.

The Association of Blue Sclerotics with Brittle Bones and Progressive Deafness. The association of blue sclerotics with brittle bones and progressive deafness (otosclerosis) is noted by Wm. Strobie[6]. In a family of 66 persons 25 were examined and of those examined 18 were found to have blue sclerotics and of these seven had progressive deafness.

Is Chronic Progressive Deafness a Rhinologic or Otologic Factor? In trying to determine whether progressive disease is more of a rhinologic or an otologic factor, Francis P. Emerson[7] attempts to establish the following propositions.

1. Any theory is only as strong as its weakest link. In the theory of conduction deafness in the many cases of Eff. O. M. S., where the hearing often remains very good although the membrana tympani may be gone, the ossicles swept away and the stapes held firmly in the oval window by organized fibrous bands, we must suppose that sound waves are still capable of inducing motion which is transmitted to the end organ by the fixed stapes.

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(6) Quart. Jour. Med., April, 1924.
(7) Ann. Otol., Rhinol., and Laryngol., September, 1924.

2. Furthermore, the theory of conduction deafness fails to account for the fact that beginning loss of tone perception always takes place in that part of the scale represented by the whispered voice, although the conduction apparatus may be free from obstruction and the low limits normal.

3. There is no explanation in the theory of damage to the conduction apparatus to account for the gradual loss of tone perception, which terminates in nerve deafness in all advanced cases of chronic progressive deafness.

4. Very many cases of deafness have a hearing test that is the same for both ears, the perception for different notes through both air and bone often not varying a second in time. It is hard to conceive of this occurring so often on the theory of conduction deafness.

5. Chronic deafness never progresses steadily, as we would expect in slowly developing obstruction in the conduction apparatus, but has periods of exacerbation, then improvement and finally remains stationary until the next cycle occurs.

6. Even in long standing cases, removal of the local focus will often be followed by improved hearing, although no treatment has been employed that would mobilize the ossicles or in any way affect the conduction apparatus. This occurs in cases that have been diagnosed as chronic catarrhal otitis media and also in so called cases of nerve deafness.

7. From clinical observations and the facts here presented it then seems logical to conclude that the gradual loss of tone perception is indicative of the damage to the perception apparatus and that the involvement of the conduction apparatus is a secondary and a minor factor in the development of chronic deafness.

The X-Ray Treatment of Deafness. Having noticed that hearing frequently improved after *x*-ray examinations, J. J. Richardson[8] has experimented with the *x*-ray for the purpose of improving the hearing. He states that electromagnetic wave lengths of a range of frequencies including visible light, ultra violet radiation, x-radiation, ultra-x-radiation and radium emanation, cause the emission of electrons from metallic surfaces upon which they impinge. And yet the changes so induced are not revealed to chemical or microscopical investigation, but must be measured by very special physico-chemical methods. Now this phenomenon, known as photo-electricity, offers us an analogy which is strikingly significant for our purpose. In 1818 Von Grotthus propounded the law, applicable to all these phenomena, that "only the energy that is absorbed can do chemical work." In spite of the fact that the chemical work done by such absorbed energy cannot always prevail microscopically, the modern science of photo-electricity enables us to deduce and defend the converse of Von Grotthus' law, namely, that all the energy that is absorbed does physico-chemical work. Moreover, we are justified in seeking its application to the phenomena of deafness.

From the viewpoint of the otologist, the clinical deduction is of paramount interest. The projection of x-radiation into the structures of the body must lead to the performance of physico-chemical work in proportion as the energy is absorbed. That the results cannot be measured by our present methods of clinical investigation in no way vitiates the certainty of this scientific fact. And in proportion, as means for detecting photo-electric effects in the tissues are evolved, so will our concrete and detailed conceptions of the possibilities of radiation-therapy expand to include this newly revealed phenomenon.

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(8) Jour. Med. Ass'n., Georgia, April, 1924.

Convinced therefore that x-radiation affects nerve structures no less than it affects, photo-electrically, other structures, the author began to use the x-ray treatment in his practice, and with a view to safeguarding such patients as had first to come within the purview of his experiments, he used very mild doses, directing the radiation to the auditory center on each side. By a mild dose he means a low voltage equivalent to about 4 inches of spark gap, or 50 kilovolts; and a low milliamperage, about 8 milliamperes. There is in all probability no need for any great quantity of energy, for Lenard early proved that the photo-electric energy of the ejection of the corpuscle is wholly independent of the intensity of the energy causing the ejection.

At the very beginning, the results were gratifying. Regardless of the character of the initial pathology provoking the deafness, many patients, who had failed to respond to the use of other methods, found their hearing acumen positively improved under the new treatment. It was soon found that the radiation could be directed practically anywhere on the head in about the quantity described, with the same betterment of hearing, clinically; this fact suggested that the therapeutic effects noted might not be depended exclusively upon the stimulation of the auditory nerve center, but that possibly the nerve itself, as well as the associated neural and non-neural tissues, might be subject to the stimulating influences of the rays.

The method, then, consists of the gentle irradiation of the head from four angles, focussing, for the sake of convenience, upon the sella turcica. First, through the temporal region on the right, direct the central ray one inch in front and one inch above the external auditory meatus; second, over the occipital protuberance, with the head inclined forward; third, the left temporal region in the same manner as the right; and, finally, through the anterior fontanelle, the head inclined backward. It has seemed to the author to be important to keep the quantity of energy used constant and nonfluctuating, and that the best results are insured with the use of a carefully stabilized current.

Whenever examination discloses the presence of anatomical pathology, as for example the lymphatic hyperplasia that accompanies some cases of Eustachian and middle ear inflammation, it seems best to use, in addition to the small photo-electric dosage already mentioned, a heavier dosage such as is known to reduce hyperplastic tissues. These applications are proportioned to the extent of the anatomical pathology revealed, and are repeated only at sparse intervals.

Some of the more striking observations that have attracted attention are as follows.

1. The author cannot discover that the original pathology plays any obviously determining role with respect to the efficiency of the treatment.

2. Improvement, when it occurs, is either astonishingly immediate, or is for some time latent, becoming apparent only after several treatments.

3. Improvement is at times followed by relapse. which has not in the author's experience ever reached the low level of the original deafness. The gain is apparently a progressive series of steps.

4. Improvement is most usually manifested in an increased power to interpret the conversational voice; next, for music in its various orchestral forms; lastly, for metallic sounds, such as the ringing of church bells, telephone bells, and similar previously undetected sounds. Occasionally a patient will show increased acuity for everything except the voice, a situation quickly recognized by the tuning fork and acoumeter tests.

5. The most striking subjective betterment is the very general disappearance of tinnitus aurium. This is most pleasing to the patient, as it is the first symptom, and a most distressing one, which is dispelled. There

are cases, however, in which the tinnitus is not materially decreased, and in an exceptionally few instances there are complaints of increased head noises.

6. The author's records show improvement, varying from slight degree to a complete cure, in not less than 60 per cent. of the cases treated, which must be regarded as a gratifying result.

7. The treatment is entirely free from any harm to the patient.

Treatment of Deafness. In obstructive deafness P. D. Kerrison[9] believes that relaxation of the drum membrane has an important part. Among other procedures for the correction of this condition he suggests the use of the rice paper splint. A disc of rice paper is cut to conform to the more relaxed or atrophied portion—i. e., the portion most noticeably defective in structure or tension, and therefore least fitted either to transmit sound waves or to withstand even slight changes in tympanic pressure. After being soaked in alcohol, the paper is introduced deeply into the canal wall. It is then slid into position and adjusted with a tightly wound cotton applicator. Such a splint, properly applied, will hold its position for weeks, though tending to move toward the nearest canal wall. Its adherence to the membrana tensa is so close that removal is difficult or impossible without soaking. If, therefore, the disc is applied immediately after inflation, its value in supporting a relaxed membrane in a relatively normal position becomes clear. The hearing may or may not show immediate gain. The purpose, however, is to reestablish more normal position and tension. If we can accomplish this, we can afford to wait upon improvement in hearing, which should logically follow.

If the steps above outlined have been successfully carried out, we should have the following tangible results: (1) A better functioning eustachian canal;

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(9) Med. Jour., and Record, May 7, 1924.

(2) a more normally placed drum membrane; and (3) a more normal balance between drum membrane and ossicles. Functionally these changes should be translated into improved hearing—not necessarily of the spectacular type which occasionally follows immediately upon inflation and is as quickly lost. Rather it should be a clearer definition for all sounds which, however moderate in degree, should be better sustained.

After discussing the subject of obstructive deafness at considerable length he offers the following summary and conclusions.

Summary. Whatever increases general vitality or vigor tends to improve audition; and whatever hearing gain accrues from such means, must be attributed to a better functionating nerve rather than to improved sound transmission. If we use every safe and rational means of stimulating the end organs of the acoustic nerve, remove all discoverable sources of infection or of nerve depression or injury, and endeavor to raise the tone or functional activity of the perceptive mechanism by improving general nervous tone and vitality, we do all that in the present state of our knowledge is possible in this direction. If we neglect this phase of the problem as of negligible practicability or importance, we neglect a factor which is logically a part of any rational scheme of treatment.

Only as we take into consideration all the factors in the production of deafness and all the potentialities of treatment logically applicable to their correction, shall we obtain for the average patient a hearing gain of permanence or value.

The author personally believes that the most important field in otology in the immediate future will be found in the treatment of deafness, that the acoustic nerve and its reactions must be made the subject of more intensive study; that local treatment must aim less at the immediate subjective relief of the patient and more at the slow building up or more normal conditions of intra-tympanic tension or balance. Definite progress along these lines is the most urgent demand upon otology today.

Conclusions. 1. The first essential in an attempt to amend any system of treatment is the elimination of all useless or harmful procedure.

2. Routine catheter inflations is dangerous to hearing on account of the pathological changes in the membrana tensa to which it may ultimately give rise.

3. Routine or too frequent use of eustachian bougies or sounds is not without risks on account of the subacute reactions in the tubal mucosa to which it may give rise.

4. The first constructive effort in treatment should be an exhaustive search for possible foci of infection. As a preliminary measure, elimination of such a focus is a most positive indication.

5. Tubal disease begins in the pharyngeal end of the canal, and local treatment confined strictly to this region gives the best average results in restoring tubal function.

6. When tubal function is not re-established by simpler means, surgical measures may prove effective.

7. Tuning fork exercises, used with care, judgment and moderation, provide a rational means of exercising both drum membrane and ossicles.

8. In most cases of advanced deafness the acoustic nerve, as well as the conducting mechanism, is involved; therefore both must be taken into account.

9. Treatment of the acoustic nerve can be considered, if at all, only from the following viewpoints: 1, Direct or local stimulation; 2, administration of drugs; 3, elimination of injurious agencies; 4, hygiene, or regulation of the patient's mode of life.

10. As there are many factors in the etiology of deafness, so is the pathology one of complexity. No inelastic rule of thumb routine of treatment will yield the best average results.

Surgical Treatment for Deafness. For the surgical treatment of the diseased tissue about the nasopharyngeal end of the eustachian tube, P. D. Kerrison[1] has devised three knives. A shows the probe, and B and C two knives for incision of the anterior and posterior lips respectively. When the nasal passage and pharyngeal end of the canal have been cocainized, the knife, whichever is to be used, is passed, catheter fashion, through the nose and introduced by slight pressure into the tube. If sharp, a clean incision may be made as the knife is withdrawn. A little practice will enable one to pass these knives without injury to turbinates or other intervening structures. Should it seem wise to incise both pillars, some days should intervene to insure against possible adhesions. While the blades of these knives may seem at first glance unnecessarily wide, a moment's reflection will show that this is a provision of safety, since the incisions are intended to be restricted to the mouth of the tube, and not to extend deeply into the lumen of the canal.

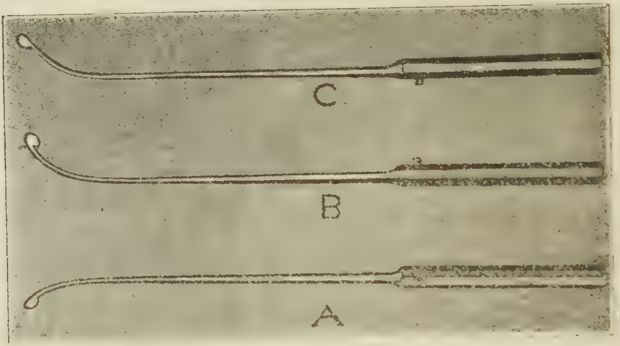

Fig. 9.—A, eustachian probe; B and C, eustachian knives for incising anterior and posterior walls respectively.

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(1) Med. Jour. and Record, May 7, 1924.

Furunculosis of External Auditory Canal. The differential diagnosis of furunculosis of the auditory canal, according to C. C. Stanton,[2] is between exostosis, granulations of external meatus, aural polyp, perichondritis of the auricle, carious teeth, parotid abscess and mastoiditis.

An exostosis is a bony prominence, hard to the touch, and usually not sensitive, whereas a furuncle is usually not so hard and very sensitive. Granulations are not painful and give a history of long duration, whereas a furuncle is an acute process. A polypus is freely movable and not tender, whereas a furuncle is not movable and very tender. Perichondritis is a diffuse process, which may involve the entire auricle, whereas a furuncle is a circumscribed process found in the canal proper and does not extend to the auricle. Carious teeth are readily differentiated by the absence of any aural tumefaction and the presence of tender teeth. Parotid abscess shows a tender swelling over the parotid gland primarily, and the pain radiates into the ear canal. The most important differential diagnosis is between mastoiditis and furunculosis, which is as follows:

FURUNCULOSIS

History

1. Former attacks common.
2. History of mechanical irritation.
3. Onset rapid.
4. Height of disease at third day.
5. May or may not be associated with an acute purulent otitis media.

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[2] Atlantic Med. Jour., August, 1924.

FURUNCULOSIS

Subjective Symptoms

1. Pain is greater than in mastoiditis.
2. Tender spots in canal.
3. More crying on insertion of speculum due to passage over furuncle.
4. Pain on irrigation.
5. Pain over parotid (in furuncles of anterior wall).
6. Pain on mastication.
7. Hearing normal or diminished, according to size of furuncle.

FURUNCULOSIS

Objective Symptoms

1. Canal narrow at orifice.
2. Tumefaction in external cartilaginous canal.
3. One or more tumefactions.
4. Discharge slight.
5. Tumefaction usually on posterior inferior wall or on the anterior wall.
6. Auricle sensitive to touch.
7. Auricle displaced forward.
8. Edema over mastoid, but no bone tenderness.
9. Tympanic membrane not perforated.
10. Tympanic membrane may be normal or slightly congested.

MASTOIDITIS

History

1. Former attacks unusual.
2. No mechanical irritation.
3. Onset gradual.
4. Disease begins usually three weeks after an acute purulent otitis media.
5. Usually associated with acute purulent otitis media.

MASTOIDITIS

Subjective Symptoms

1. Pain is less than in furunculosis.
2. No tender spots in canal.
3. No crying at insertion of speculum except from fear.
4. No pain on irrigation.
5. No pain over parotid.
6. No pain on mastication.
7. Marked deafness.

MASTOIDITIS

Objective Symptoms

1. Canal narrow at fundus.
2. Tumefaction in internal osseous canal.
3. One tumefaction.
4. Discharge usually free.
5. Tumefaction on the posterior superior wall.

6. Auricle not sensitive to touch.
7. Auricle displaced forward and downward.
8. Edema and bone tenderness.
9. Tympanic membrane perforated and discharging.
10. Tympanic membrane shows signs of acute purulent otitis media.

External Otitis. Its Cause and Prevention. Irritation of the auditory canal caused by moisture is discussed by G. E. Adkins.[3] Of the local irritants constant or frequent, moisture stands far in advance of all others and it is this condition that we know so well as the ''swimming pool'' ear, and it does not mean that one must go in a swimming pool to produce the condition, for it is due to moisture that finds its way into the canal from any source, and moisture that does not necessarily take with it infectious micro-organisms.

Remember that the external canal is lined with skin, not a mucous membrane, and that this same skin is reflected over the external surface of the tympanic membrane; and that owing to its location it is not subject to the external forces that give the balance of the body coverings a higher degree of resistance to irritants, sunlight seldom if ever coming in contact with it makes it more susceptible to an irritant.

It is not always easy to say whether we have an external otitis to deal with or a mastoiditis. And again it is like all other chapters in medicine; a diagnosis is to be made before intelligent treatment can be instituted.

Moisture gains entrance into the canal and if not dried out sets up the desquamatory process, and the products of desquamation soon are sufficient to plug or almost plug the canal; this prevents evaporation of moisture and enhances desquamation until the skin is abraded and infection follows. On looking into the canal of an ear that has been subject to constant moisture for a few days one can see the springing up

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(3) New Orleans Med. and Surg. Jour., August, 1924.

of the products of the yeast fungi that grows only in the presence of constant moisture; and it was to relieve just this condition that pharmaceutical houses put out and recommended the use of Bulgarian bacillus in the external canal in cases of otitis. To them it was an empirical remedy, but to us it bids fair to become a rational one.

After cleaning the canal it is customary to apply a swab wet with borated-alcohol and to prescribe borated-alcohol to be dropped into the canal once daily. The condition usually recovers without further attention. Usually when these cases are referred or come to us from some one else we have to explain to them why it is not a good idea to irrigate the canal two or three times daily with warm water or warm boric-acid solution for they likely will have had it prescribed by their physician.

Control, Through Nasal Ganglion, of Earache of Laryngeal Origin. Two cases of reflex pain in the ear from cancer of the larynx relieved by cocainization of the nasal ganglion are reported by S. H. Clerf.[4] He states that the results obtained by this procedure have been most gratifying. The relief is almost immediate, and is lasting. It is more efficacious than morphin, and is not followed by the ill effects that result from the frequent administration of that narcotic. The simplicity of the procedure makes it readily applicable. It should be utilized in all cases of reflex otalgia of laryngeal origin.

Improving the Hearing in Catarrhal Deafness. Improvement in hearing in catarrhal deafness through stimulation of the nasal ganglion and the sympathetic nerves is reported by P. V. Winslow.[5] After reviewing the anatomy to show the intimacy between the nerve supply of the two organs, he stated that after stimulation of the nasal ganglia and trigeminal nerves he

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(4) Jour. Amer. Med. Ass'n., Feb. 23, 1924.
(5) New York Med. Jour., August, 1924.

has seen drops of fluid on the drums and in those cases in which deafness was associated with a purulent discharge there was on several occasions an acute exacerbation of the discharge which in a number of cases at a later period disappeared altogether. The eustachian tubes as a result of this stimulation are opened and patients say that the ears feel much lighter and many of them are conscious of the air rushing into the ears.

A purulent discharge in a patient which two mastoid operations failed to check subsided one month after nerve stimulation in the nose. In a few cases which had a chronic purulent discharge the stimulation in the nose so stirred up things that slight involvement of the mastoid with pain and tenderness followed, but cleared up in a few days, an operation to relieve the mastoid condition not being necessary. The author believes that this stirring up of the middle ear discharge is the result of Gasserian ganglion influence secondary to trigeminal stimulation.

Deafness of nearly every type seems to vary with the general physical condition of the patient. Good hearing depends a very great deal on muscle tone, not only in the ear but in the entire body. Many patients suffer from a greater degree of deafness than the pathology in the ear itself warrants.

The author offers the following technic. After the patient has been examined and the case found to be that of catarrhal deafness the following treatment is carried out.

The high frequency current is applied to the skin around the eyes strong enough to produce spasm of the orbicularis palpabarum muscles; it is also applied to the skin of the face, neck and ears for a period of five minutes.

Plain cotton on an applicator is caused to tickle the mucous membrane in each nostril for two minutes.

The nose is then cocainized, the flakes rubbed on the mucous membrane by means of a cotton applicator which has been dipped in adrenalin solution.

The author usually removes a portion of the middle turbinate on each side so he can get to the region of the spheno-palatine ganglion. The cotton applicator saturated with cocaine and adrenalin is caused to rub over the mucous membrane covering over the spheno-palatine and otic ganglia for three minutes on each side of the nose.

Two weeks later the patient is given some voice and reading exercises to stimulate the auditory nerve and its dormant fibers to activity. To strengthen the voice and bring it up into the head cavities he has his patients three times a day sing the vowel ''E,'' making it decidedly nasal, also a humming exercise on the consonant ''M'' and in such a way that the lips can be felt vibrating. It is surprising what a beneficial effect this vowel ''E'' exercise has in improving a catarrh of the nose and throat; also in reducing the head noises. It lessens congestion in the nose, thereby providing better ventilation and drainage. These exercises cover two-minute periods each.

Pain in the Ear. Pain in the ear as a symptom is considered by T. M. Sulzman.[6] When properly interpreted pain holds a prominent place in our regular routine in all ear work. If in the examination the patient endeavors to move away when the auricle is touched, if pain be constant or worse when the mouth is opened or closed the lesion is in the external canal and we shall be safe in making a diagnosis of acute otitis externa. Cases of acute otitis externa that are not seen early may cause a good deal of swelling over the mastoid area with the usual signs of mastoiditis, and we should carefully examine the canal and drum membrane in all.

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(6) Surg., Gynec. and Obst., February, 1924.

If no pain is noticed when the finger is pressed over the mastoid, but pain is present upon pressure up and inward under the lobe of the ear, the pain worse at night and in the recumbent position, the trouble is in the middle ear and will be verified by further examination of tympanic membrane.

Mastoid pains vary with the character of bone which is being dealt with. The pneumatic and ebony type will each have special symptoms. In the soft pneumatic bone pain on pressure will be great, but the patient will complain very little, as pus has found an easy passage toward the cortex. In the ebony type the patient complains of much pain and pressure will not reveal it even until later in the course of the disease. No matter what the history or symptoms, as a regular procedure in all inflammations about the ear, one must test out carefully for any of the painful points in the mastoid region, especially the area over the antrum and tip. There is still another type of pain about the mastoid, extremely troublesome when found painful on pressure. The patient complains of severe distress as in an ordinary mastoid infection; yet examination of the canal and middle ear shows no true ear involvement. We have here an otalgia to deal with and the foci of infection must be looked for in the tonsils, teeth, or other parts of the body. A mastoid operation is unnecessary.

With a history of pain followed with or without discharge from the ear, with a marked rise of temperature, 104-105 degrees, dropping to nearly normal in a short time, and this is repeated in 24 hours, we must consider a possible sinus thrombosis.

A case with headache and vomiting and a history of previous ear discharge with or without pain directly in the ear, should warn us of a likely intracranial complication, meningitis especially. Pain is one of the early symptoms of brain abscess and we should remember that the site of pain is no guide to the location of the abscess, occipital pain being present in many cases of temporosphenoidal abscess, while frontal pain is found in cerebellar involvement.

Mechanism of Pain as Seen in Otological Cases. In a discussion of pain as related to the ear, L. Hubert[7] gives the following points of differentiation between organic and psychic pain.

1. Psychic pain is a cortical pain, i. e., impulses are transmitted from the cortex to the periphery. Organic pain is an optic thalamic pain, i. e., impulses are transmitted from the periphery to the pain center in the optic thalamus.

2. *Tenderness Test:* Neurotic persons will not allow the examiner to use this test, but when their attention is distracted, pressure will not increase the pain. A fairly reliable sign in psychic pain is the fact that superficial contacts, like combing the hair, are very painful, while deeper pressure may cause no discomfort. Organic pain is increased in intensity when sufficient pressure is used to send stimuli to the optic thalamus.

3. The pulse rate and blood pressure are increased in organic pain, when the painful area is pressed, but not in psychic pain.

4. *Pain Reflex:* It consists of an involuntary pulling away of the painful part when touched. It is present in organic pain, but not in psychic pain. In the neurotic there is a voluntary movement of the affected part, which may confuse the examiner.

5. *Facial Expression:* In organic pain there is a narrowing of the palpebral fissure, especially at the outer canthus. This is due to stimulation of the optic thalamus, and is therefore not present in psychic pain.

6. *Pupillary Reflex:* In organic pain there is a dilatation of the pupils, which is probably also of thalamic origin. It is absent in psychic pain.

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(7) Laryngoscope, August, 1923.

7. *Effect of pain on sleep:* Psychic pain does not interfere with sleep. Organic pain does.

In a summary he states that there are three general types of pain: 1, Somatic; 2, Autonomic; 3, Psychic.

In the somatic type, the pain is due to irritation of the pain sense organs or the pain nerve fibers of the ear. It may also be due to irritation of the same nerves or closely related nerves that are distributed to structures at some distance from the ear (otalgia). In the latter instance, there is no disease of the ear proper, but only pain, which is felt, either in front, within, or in back of the ear. It may be present just in front and within the ear, within the ear alone, or within the ear and over the mastoid region. In intelligent patients it is often possible to diagnose the cause of the otalgia by the location of the pain.

Somatic pain may also be due to involvement of any of the six sensory ganglia that supply the ear with sensation. This may manifest itself in a specific infection of these ganglia, resulting in herpes zoster.

Idiopathic neuralgia of the sensory nerves to the ear, similar to trifacial neuralgia or tic douloureux may occur. Involvement of the posterior roots of these nerves may also cause severe pain in or around the ear.

Pressure on the dura mater, which, with one exception, is the only sensitive part of the brain, causes more or less characteristic pain. This pressure, from the otological standpoint, may be caused by otogenic meningitis, temporo-sphenoidal and cerebellar abscesses and tumors of the cerebello-pontine angle. All diseases of the brain which do not produce any pressure on the dura do not cause any pain. The one exception is the posterior part of the optic thalamus, which contains the pain center. Irritation of this part produces a typical thalamic syndrome with characteristic pain.

The presence of autonomic pain in or around the ear has not yet been definitely proved. Its existence will depend upon the circumstance whether or not afferent autonomic fibers are present in the nose, nasopharynx, and buccal cavity.

Psychic pain has its origin in the cerebrum, and for one reason or another is referred to the ear, especially to the mastoid region.

Experimental Injury by Sound. In a series of experiments, Kimura Motogoro[8] has demonstrated that shrill sounds either long continued or intermittent will break down the organ of Corti and cause atrophy of the nerve-fibers and ganglion cells related to it. The experiments were made on white mice. The same sounds produced atrophy of the papilla acoustica within a circumscribed area in pigeons.

Tinnitus Aurium Associated with Abnormalities of Blood Pressure. Tinnitus aurium associated with abnormalities of blood pressure is discussed by H. M. Wharry.[9] In estimating the severity of tinnitus he has come to divide them into two groups, the typical "slight" case, and the typical "severe" case. There are, of course, many intermediate cases and an occasional "extreme" case.

The *slight* cases are divisible into (a) those who complain of deafness only, from whom the presence of tinnitus may be elicited by questioning; (b) those complaining of slight tinnitus, with or without deafness. Many of these will confess that they believe the tinnitus is always there, but they notice it only when they have nothing to do. They usually forget all about it for most of the 24 hours. It does not prevent them from sleeping. This class forms the majority of all cases of tinnitus.

In *severe* cases the hall-mark is insomnia. It consists of those who, whether deaf or not, say they would not mind anything if only they could get to sleep and forget the terrible noises in the head. They may either

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(8) Ztschr. f. Hals-Nasen-u. Ohrenhlk, May, 1924.
(9) Lancet, May 3, 1924.

volunteer the statement, or disclose it without any too particular questioning, but there is very little doubt of them, as distress and anxiety are plainly written upon them. They are very neurasthenic, but the neurasthenia is the effect rather than the cause of their trouble, and disappears under successful treatment of the condition causing it. There are extreme cases who are eventually driven to suicide or lunatic asylums by the ceaseless horror of noise that will not leave them.

Conclusions. 1. Cases of severe tinnitus aurium with abnormal blood pressure form a large and important group in which much distress can be relieved.

2. Severe tinnitus aurium may be due to a high blood pressure alone or to a low blood pressure alone, in which case it is usually found to be bilateral.

3. It may be due to an aural lesion combined with a high blood pressure, or with a low blood pressure, in which case the tinnitus is on the side of the lesion.

4. In the circumstances just quoted the tinnitus may be cured or improved by removing the aural lesion alone, or by reducing the blood pressure to approximately normal, or by doing both.

5. Trinitrin is of great value as a therapeutic agent in the cases associated with a high blood pressure, as it appears to have a specific effect in relieving the tinnitus.

Tinnitus Aurium. Tinnitus aurium is a symptom encountered in many diseases, according to T. R. Morgan,[1] whose purpose in writing is to show that the specialist and the general practitioner should work in close conjunction in the treatment of this condition, and that they should endeavor to find and treat the cause instead of the effect.

A great many of these patients will not only complain of noises in the ears or head, such as popping sounds, church bells, hissing of steam, whistling,

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(1) Clin. Med., April, 1924.

chirping, or like the noise of a distant railroad train, but also of nausea and vertigo. These noises are either intermittent or continuous and are always worse when the patient is lying down, or at times when his mind is not engrossed with other matters.

Tinnitus aurium is sometimes found in diseases of the heart with insufficient compensation. In these cases, there is a tendency to congestion of the mucous membranes and tissues of the head, causing a hemorrhage in the labyrinth, thus producing the symptom of tinnitus.

We also have these hemorrhages into the labyrinth sometimes occurring in patients having high blood pressure, also in arterio-sclerosis, causing nausea, headache and vertigo in addition. If this appears in a person having considerable deafness, there is a tendency of making a wrong diagnosis of labyrinth disease. In all of these cases, having these four cardinal symptoms, the diagnosis will be greatly facilitated if the conditions of the arteries be noted and the blood pressure taken.

In anemia of any form, we are likely to have hemorrhages in the labyrinth, thus producing the symptoms of noises in the ears.

In leukemia, we often have a hemorrhage in the labyrinth, accompanied with deafness as well as tinnitus aurium.

In chronic interstitial nephritis, tinnitus, vertigo and deafness may be observed, and also in parenchymatous nephritis, although to a lesser degree.

In neurasthenia, the most frequent oral disturbance is tinnitus. This symptom is variable, changing from time to time, and is always worse during fatigue and during attacks of anger or of other emotions. The patient is always better in the morning after a complete rest, but the symptoms return during the day with marked depression.

In syphilis affecting the internal ear, there is a loss of hearing by bone conduction and for high tones. Nystagmus, which is spontaneous, is also present. The infection is nearly always bilateral. There will be tinnitus, deafness, dizziness and a staggering gait. The dizziness and staggering gait usually disappear after a few days or weeks, but the deafness is likely to be complete and permanent.

The tinnitus is usually worse when lying down at night, and will probably not be present at all during the day time. It may disappear entirely for months and then return again. It will probably disappear entirely during the last stages of the disease. Involvement of the labyrinth may increase or decrease tinnitus, according as the nerve fibers are simply irritated or destroyed.

Otological Cases of Interest to General Practitioners. A case of hypothyroidism with ear symptoms is reported by F. T. Hill.[2] The patient, a woman 62 years of age, had complained of deafness and tinnitus in both ears, for which she had been under treatment for the past three years by several specialists. She had had a great deal of inflation of the tubes and all sorts of local treatment, but without any improvement; in fact, she had been rapidly going down hill. Examination showed a short, thick-set woman, with heavy, coarse features, skin rough and thick, hair coarse, considerable puffiness and edema at the eyebrows, hands short and stubby. Her speech was thick and she said that her tongue felt too big for her mouth. Her ears were negative in appearance, except for the same dry, scaly condition of the canal as noted elsewhere with the skin. Her nasal mucous membranes were badly congested and her tonsils inflamed. Hearing: right, 1/20; left, 1/40. This was obviously a picture of hypothyroidism or myxedema. The deafness and tinnitus were simply one manifestation of this trouble, which, as Sajou has

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(2) Maine Med. Jour., March, 1924.

pointed out, is seen fairly frequently in these cases. This is probably caused by a submucous infiltration, as shown by the nasal condition and a consequent disturbance of the conduction apparatus.

When we consider the ultimate outcome of these cases which are not discovered and treated, we realize the importance of careful diagnosis in these cases. Not alone deafness, but insanity and a wasting death would have been this woman's fate.

THE MIDDLE EAR.

Bacteriologic Study of Middle Ear Infections. In an exhaustive study of the bacteria found in middle ear infections by E. Valentine,[3] the following points were considered.

1. The relative prevalence of the different bacterial varieties in a series of acute and chronic cases of otitis media.

2. The bacterial flora of the discharge of the ear of a certain number of patients with acute infections at intervals extending over a considerable period of time. It was anticipated that the findings might throw light on the course and the prognosis of the infection.

3. The throat flora of a number of persons with acute respiratory infections prior to the development of an ear condition in order to trace bacteriologically the source of the ear infection.

4. The throat condition in all cases of otitis media at the time of the original paracentesis and also later to determine whether the anatomic, clinical and bacteriologic picture of the throat had any relation to the severity and subsequent history of the ear condition.

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(3) Jour. Infect. Dis.,

5. A detailed study of the bacterial variety found in the majority of the acute cases in order to ascertain whether there was a specific serologic variety which had a peculiar affinity for an elective localization in the ear.

6. A consideration of the ultimate condition of chronicity or deafness in the cases of acute middle ear disease from the standpoint of the original bacterium found in the ear infection.

7. The relation of the different varieties of secondary invaders to the final condition of chronicity.

Regarding the practical value of vaccine therapy it is evident from the results showing the heterogenicity of the bacterial varieties found in this series of cases that vaccine therapy in otitis media is a method of treatment not to be attemped blindly. In regard to streptococcus infections, the value of vaccines is a subject of debate at the present time. If beneficial results are obtained only when the specific organisms are used in treatment, the data presented in this report, namely, that the beta hemolytic streptococci found in the majority of ear discharges are immunologically different when tested by agglutination, would indicate that the use of a mixed stock vaccine would not be efficacious. If, however, further work should show that serologically different streptococci will give cross protection, then a mixed streptococcus vaccine might yield results. How far the "non-specific" factor might influence the therapeutic results remains to be decided.

From the standpoint of specific therapy, the use of autogenous vaccines made from the streptococcus isolated from the original ear discharge may be applicable, as it is shown that, in the majority of cases, the original streptococcus persists in the ear discharge and in the throat. However, the two cases, in which the group of streptococcus changed, indicate that a thoroughly controlled course of vaccine treatment in any individual case entails serologic tests on the organisms isolated at succeeding weekly intervals.

The use of a diptheroid vaccine in cases of suppurative otitis media, mostly postcarlatinal, has been reported by Hamilton. The results as tested by opsonic determination suggested a certain benefit, and she concludes that "by the injections of dead cultures of the homologous strain, the patient's opsonin to that strain can be increased." She also studied the relationship of the pseudodiphtheria bacilli in otitis media, and claims to have differentiated two distinct groups when tested by bacteriolytic and agglutinative methods.

Since organisms of this group have been found in this study as the most frequent secondary invaders in the acute infections and as common inhabitants of the discharge from chronic cases, it would seem that further immunologic work leading to possible vaccine therapy might be of value. If certain acute cases could be immunized against this apparently pernicious secondary invader, results might be accomplished in preventing chronicity and deafness.

The beta hemolytic streptococcus is probably the most important etiologic organism in the majority of acute middle ear infections in San Francisco. In a small percentage of cases, staphylococci, pneumococci, green (alpha) streptococci, and diphtheroid bacilli predominate.

The organisms obtained from 12 chronic cases, in pure or mixed culture, include diphtheroid bacilli, staphylococci, B. pyocyaneous, B. proteus, and B. coli.

A study of the throat flora in relation to the bacteria found in the ear discharges of acute middle ear infections reveals that in cases in which the beta hemolytic streptococcus, pneumococcus, or green (alpha) streptococcus are the apparent exciting factors in the ear discharge, and the same bacterial species are found in the throat.

The indication as to the possible source of the ear infection, although not the final proof, has been secured by testing serologically the strains of beta hemolytic streptococcus of which cultures have been made simultaneously from the primary ear discharge and from the throat in the individual case. The results obtained in the 9 cases studied with reference to this point show that the same serologic variety of streptococcus may be present in the throat and in the ear discharge.

In the majority of cases, cultures made from the ear discharge several days or a week after paracentesis show that the apparent etiologic bacterium has become reduced in number, while the proportion of other varieties has increased.

Two cases have been encountered in which the beta hemolytic streptococcus has persisted in the ear discharge over a prolonged period. Further tests have shown that a different fermentative group of hemolytic streptococcus has appeared and finally supplanted the earlier variety. It is suggested that the presence of a second virulent variety may account for the prolonged duration of the disease in these cases.

Except for these two cases, the beta hemolytic streptococcus obtained in subsequent cultures from the ear discharge and from the throat in each individual case belongs to the same fermentative group as the hemolytic streptococcus isolated primarily from that case. Serologic tests carried out on the strains from 9 cases show that all strains isolated originally and subsequently from a single individual case are similar.

In 19 out of 22 cases of bilateral otitis media involved at approximately the same time, the same bacterial species has been obtained in the primary culture from both ears in each individual.

Nine cases of bilateral infections yielding beta hemolytic streptococcus in the primary culture have been studied. In 8 cases, the strains isolated from both ears belong to the same fermentative group, and serologic tests carried out on the strains from 4 cases show that both ears have been infected with the same antigenic variety. One case was investigated in which the beta hemolytic streptococcus found in apparently pure culture in the right ear was of a different fermentative group than that occurring in the left ear. Since the original material was collected from the ear discharges several weeks after spontaneous rupture, no conclusions can be drawn in regard to the primary etiologic organisms.

Otitis Media, Etc., as a Factor in Malnutrition in Children. T. H. Odeneal,[4] writing of his experience in the Canal Zone states that 75 per cent of all colored children suffering from malnutrition had middle ear disease and in 80 per cent of all deaths from this cause the autopsy showed mastoid involvement.

Pathological Changes in the Membrana Tympani. Harold Hayes[5] shows a number of drum membranes taken from actual cases. (Plates XXVI, XXVII, XVIII.)

Local Anesthesia in Otology. According to H. Neumann[6], complete anesthesia of the drum membrane and tympanic cavity can be produced by injecting a 1 per cent. solution of cocain with a drop of adrenalin into the upper posterior wall of the auditory canal. Because of conditions unfavorable for absorption in periosteal abscess local anesthesia in these cases is not indicated.

Otitis Media in Infants and Children. In this paper C. D. Sweet[7] undertakes:

1. To emphasize the necessity of the inspection of the membrana tympani as an important part of the physical examination in all infants and children.

2. To point out that, if the relief afforded by early diagnosis is to be given the patient, this examination must be made by the family physician, for the reason

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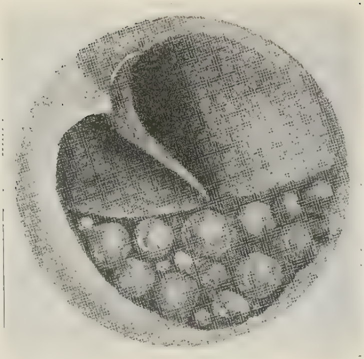
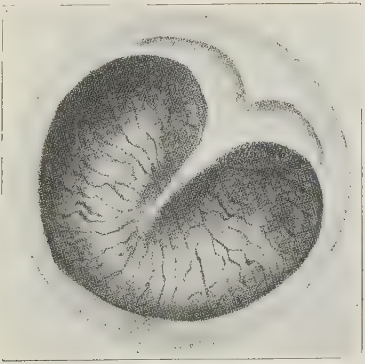
(4) Ann. Otol., Rhinol., and Laryngol., June, 1923.
(5) Ann. Otol., Rhinol., and Laryngol., September, 1924.
(6) Ztschr. f. Hals, Nasen-u. Ohrenhlk., May, 1924.
(7) Calif. State Med. Jour., October, 1923.

PLATE XXVI.



Acute inflammation. There is an exudate behind the drum which bulges considerably, particularly in the lower portion where the bubbles of air can be seen. In cases of this kind, the short process of the malleus does not, as a rule, show up so well.

Diagnosis: Acute tubotympano-otitis with exudate.—Hayes, page 252.



Acute inflammation. Exudate—probably pus. There is bulging of the drum, elimination of light reflex and an intense redness. The malleus is still visible.

Diagnosis: Acute tympanitis with otitic exudate.—Hayes, page 252.

that only those cases with sufficiently marked and definite symptoms to enable the parent to make the diagnosis fall directly into the hands of the aurist.

3. To call attention to the fact that the necessary skill required to make this inspection can be acquired with a moderate expense of time and diligence by any intelligent physician.

4. To illustrate by brief summaries of cases which have been under his care, the variety of symptoms which may be present in cases of otitis.

5. To re-emphasize the necessity of early paracentesis of the tympanum, in order to prevent serious and prolonged inflammatory processes with their attending dangers.

The results in properly managed cases and in those cases harboring a virulent organism are extremely unfortunate, resulting in loss of life from secondary meningitis, cerebral abscess, or septicaemia, and with loss of, or at least with placing in jeopardy, a greater or lesser percentage of the acoustic function because of mastoiditis with its attendant chronic otitis.

That otitis media cannot be diagnosed except by a careful inspection of the tympanic membrane is evident to anyone who follows a few cases in infants and children. Pain is by no means a constant symptom and, when present, may be referred to the frontal region, the opposite ear, or to the posterior cervical region. Small infants may keep up a more or less constant rolling of the head, probably because of the presence of pain or headache. The belief, however, that pain accompanies all inflammatory process of the middle ear is widespread not only among laymen, but also among members of the medical profession. In young infants an otitis that produces inflammation of considerable degree may often be detected because manipulation of the auricle is painful. Often the mother's attention is attracted to the ear in this manner. This complaint on the part of young infants is produced because the absence of a bony external auditory meatus permits movement of the area of infiltration about the membrana tympani. This symptom disappears in older children because the cartilage of the meatus becomes separated by a well-defined bony meatus, and the tympanic membrane no longer shares in its movement.

Vomiting is a fairly common presenting symptom of febrile or afebril otitis, especially in young or marantic infants. Many textbooks state that otitis is rare during the first few weeks of life, but we have repeatedly seen it in infants under one month of age. Even in these very young infants its incidence is great enough to make inspection of the ears an important part of the physical examination. In examining young infants, it is well to remember that the tympanic membrane lies almost vertically across the canal, and that it can be seen by slight downward and forward traction on the tragus rather than by backward traction, which is practiced on the older child.

Intestinal indigestion or colic sometimes has as its cause an afebrile catarrhal or purulent otitis. This condition should especially be given consideration if the symptoms are present only or in most marked form at night, and a history of an acute coryza within the preceding ten days makes one consider it as the most probable cause. Frequently we see infants who have been subjected to most unreasonable food changes and deprivations—even weaning from an adequate breast milk supply—when examination and treatment of an otitis was the only indicated treatment.

Otitis Media Complicating Operations on the Gasserian Ganglion. Four cases of otitis media following operations on the gasserian ganglion are reported by H. R. Lyons.[8] In each of the cases the inflammation began as a nonpurulent type but in two the discharge became purulent by secondary infection while in two

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(8) Mayo Clinic, section on Otolaryngol. and Rhinol., and, Jour. Amer. Med. Ass'n., Jan. 20, 1923.

the inflammation subsided without any perforation. Two of the cases had corneal ulcer on the side of the ganglion operation.

In many respects, the picture of otitis media due to trophic disturbances following gasserian ganglion operations simulates herpes zoster otiticus, differing chiefly, however, in that pain is absent in the former and severe in the latter; also, the bleb formations on the pinna are absent in this form of otitis media.

Sensory and trophic nerve supply to the mucous membrane of the middle ear is abundant, and it is directly connected with the sensory root of the gasserian ganglion. The tympanic plexus in the middle ear also has direct connection with the posterior root of the fifth cranial nerve, the sphenopalatine ganglion and the cervical sympathetic nerves.

The sensory nerves to the external auditory canal are derived from the auriculotemporal branch of the trigeminus, and from the auricular branch of the pneumogastric. The latter, is also known as Arnold's nerve, perforates the wall of the meatus, and supplies its lining membrane.

1. Secretory otitis media following operation on the gasserian ganglion is an entity. It is probably due to trophic disturbances in the mucous membrane of the middle ear.

2. The nerve connections between the gasserian ganglion and the mucous membrane of the middle ear are abundant.

3. The ear and eye complications are always on the side on which the operation is performed.

4. Trauma, as an etiologic factor, is eliminated so far as the ear is concerned, and this gives further basis to the argument that the corneal complications are entirely trophic in origin.

5. The process may be similar to that occurring in herpes zoster otiticus.

End Results in Suppurative Otitis Media. T. U. McManus[9] likens the middle ear to one of the accessory sinuses with drainage through the eustachian tube. There can be no possible defense for making an unnatural drainage of the middle ear through the drum and neglecting to attempt establishment of the natural drainage through the eustachian tube.

For the purpose of giving adequate natural drainage, the adenoids, or remnants of adenoids, should be most carefully removed first with curette, then with gauze over the finger, and concluded by careful examination with uncovered finger. If the patient is of cooperative age, postoperative drainage should be favored through the eustachian tube by suction. The tonsils should be removed, but not until the patient has recovered from symptoms of acute infection.

The end results in suppurative otitis media are often disappointing, because the patient considers himself cured when there is no longer pus in the external auditory canal. This misunderstanding should be corrected. Often the opening in the drum does not close. With the inflammation out of the drum, touching the edges of the opening with 10 per cent. silver nitrate will often encourage closure. Return to normal is encouraged by massage of drum and inflation of middle ear alternative days for a couple of weeks. Patients should not be allowed to wear cotton in the ears after drainage has lessened.

Scarlet Fever Otitis. Otitis media associated with scarlet fever occurs in two forms according to F. B. Gilhespy[1]. In one class the ears commence to discharge in the first week of scarlet fever, or this might not occur until the sixth or even the tenth week. If it occurred during the afebrile stage there seemed to be two modes of onset, one marked by an initial rise of temperature, often with pain, the other being painless

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(9) Jour. Iowa State Med. Soc., April, 1924.
(1) Lancet, May 10, 1924.

and without any rise of temperature, so that the first indication was the finding of some discharge on the pillow in the morning. In the first type the rise of temperature might precede the discharge by a day or two, and if this danger-signal was appreciated, paracentesis could be performed in time. The author emphasises the fact that the naso-pharynx was always primarily involved in scarlet fever. Therefore, at his hospital it was the custom to remove the adenoids if the ear discharge was not resolving.

Primary Diptheria of the Middle Ear. A case of diptheria of the middle ear is reported by G. F. Keiper[2]. He also reviews the literature and states that this condition can best be diagnosed by a microscopic examination of the aural discharge fortified by a biological test upon guinea pigs. The clinical symptoms are to be carefully noted, for the discharge from such an ear is very characteristic, totally unlike other cases of purulent otitis media.

Conclusions. 1. This disease is rare, perhaps. Therefore, all suspicions, dirty, watery discharges from ears should be microscopically examined invariably.

2. Antitoxin in large doses is always indicated and for the average-sized child not less than 30,000 units within twelve hours to begin with.

Nothing else will cause reduction in temperature and cessation of the discharge, promptly. It may also be instilled directly in the affected ear.

3. The disease can be diagnosed positively only by a bacteriological examination of the discharge from the ear together with a bilogical test to differentiate the true Klebs-Leffler bacilli from the false ones.

How the disease invades the middle ear without throat and nose manifestations is a problem yet to be solved.

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(2) Laryngoscope, June, 1924.

Routine Treatment of Acute Otorrhea with Especial Reference to Children. Hospitalization of all cases of acute otitis media is recommended by Otis Wolfe[3].

He divides the treatment into three parts. 1. Care of the general condition. 2. Care of the ear. 3. Care of the nose and throat. In the care of the ear he depends upon, *a*, peroxide; *b*, irrigation; *c*, suction; *d*, alcohol 50 to 75 per cent. Peroxide is instilled in the ear, and allowed to remain three to five minutes; the ear is then irrigated with warm boric solution. Suction is next applied (he uses one of the portable electric machines with glass suction tip). Alcohol is now dropped in the external canal and allowed to remain for some time, while the patient lies on the opposite side. Argyrol or silvol is dropped in the nose with a medicine dropper, the patient meanwhile lying on his back. Some operators object to peroxide but his experience does not sustain the objections. Peroxide breaks up and dislodges the pus secretions by its explosive action. If the suction is being frequently applied, peroxide need not be used every time. Irrigation is advocated instead of mopping, being safer and more easily administered by the average nurse. After the external canal has been cleaned, suction is applied and should the peroxide or the irrigating fluid have penetrated beyond the drum, it will be withdrawn by the suction. This meets the objection offered to the use of hydrogen peroxide, and irrigation.

When first used, suction should be rather lightly applied, the patient's complaints of discomfort or pain being the chief guide. He controls the amount of suction by using a glass tip which has a hole in it over which the finger can be placed. One quickly learns the proper amount of suction and the finger can be more quickly released if suction becomes painful than with any sort of valve or gauge apparatus. The glass tip should be too large to penetrate the canal to any

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(3) Jour. Iowa State Med. Soc., January, 1924.

considerable depth. A desirable "milking" action is obtained by slightly withdrawing and reinserting the tip. The patient's head should be inclined to the affected side so as to utilize the effects of gravity.

In regard to alcohol solution in the ear after suction, there is some doubt as to its necessity. It is of secondary consideration, at least. In the early stage he sometimes uses 5 to 10 per cent. phenol in glycerin as its hydroscopic action is beneficial. In the late stages, compound tincture of benzoin and powdered boric acid are sometimes used, and many other suitable applications could be mentioned.

The Use of Gentian and Acriviolet. In the treatment of acute suppurative otitis media after incision J. H. Abraham[4] recommends acriviolet. A wick of gauze, saturated in 1/250 acriviolet is put into the external auditory canal as far as the tympanic membrane and the auricle is covered with a dressing of cotton to absorb the drainage and is held in place by a two-inch bandage. On the following day, all dressings are removed and the canal douched with plain sterile water. The patient is then placed in a recumbent position with the diseased ear upwards. A few drops of a 1/250 solution of acriviolet is put into the canal, the tragus is massaged and the auricle pulled upwards and at the same time the patient is directed to open and close the mouth in order to allow the dye to gravitate into the middle ear so as to come in direct contact with the diseased mucous membrane. The number of douchings and applications of dye is regulated according to the amount of discharge, varying from two to four days. As a whole, the treatment has been extremely satisfactory. The ordinary bacteria that are found in these diseases were present.

Otitis Media. For the relief of pain in the ear, L. J. Curtin[5] suggests the following formula:

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(4) Laryngoscope, August, 1924.
(5) Practitioner, October, 1923.

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Acid. Carbol. liq.	min. v
Cocain. Hydrochlor.	gr. v.
Menthol.	gr. v.
Glycerini.	dr. i.

Suction in Treatment of Septis Ears. Syringing of the ears of children is severely condemned by W. Stuart-Low[6]. It is essential that the practitioner, who in almost all cases has the patient suffering from a discharging ear under his treatment for some time, it may be for months, should realize the disadvantage, not to say danger, of aural syringing. He sees the patient in the earliest stages, and has a much better opportunity than the specialist, who commonly only comes on the scene after the trouble has been long established or complications have arisen.

The intricate anatomical arrangement of the middle ear and its accessory recesses is favorable to bacterial activity. The best known methods of combating bacillary ravages in this region, other than a surgical operation, consist of forcibly syringing out accumulated discharges, and the instillation of antiseptic drops. But the risks involved in syringing out the middle ear in the presence of a chronic discharge are very great. This is aptly illustrated in the case of cholesteatoma. Even the advocates of forcible syringing invariably add a word of caution when dealing with this. Usually, in cholesteatoma, especially if it has arisen, as is almost invariably the case, after prolonged sepsis, there is found an enlargement of the normal aural cavities and mastoid cells, and any watery lotion, if powerfully injected, can easily be driven far afield into the recesses. The effect of syringing is to cause swelling of the semi-desiccated accretions and accumulations, and pressure on the surrounding brain and labyrinth. All watery fluids encourage septic change and bacterial growth.

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(6) British Med. Jour., July 14, 1923.

The author claims to have seen many cases in young children, in whom the syringing of running ears has been ordered, where the immediate result of a more than usually forcible injection by the child's mother has been acute mastoiditis and abscess. Indeed, but few cases of acute mastoiditis in children have come under his notice where syringing has not been the customary treatment, with the result that an immediate cortical mastoid operation which might otherwise have been unnecessary was rendered imperative.

He believes suction for cleansing is safer and is far more efficacious.

The Treatment of Purulent Otitis Media by Ionization. The treatment of suppurative otitis media by zinc ionization is discussed and advocated by H. L. Warwick[7].

In the electrolysis of tissue there is a double decomposition. The salts in the tissue split up and the alkalies are liberated at the cathode and the acids at the anode. The alkali metal decomposes the water in the neighborhood of the cathode (negative pole), liberating hydrogen, which appears as bubbles of gas. The acids from the salts contained in animal tissue are liberated at the anode (positive pole), and generally oxygen is liberated, but the reaction which takes place at the anode depends very much upon its composition. If the electrode is of zinc, then chloride of zinc is formed.

In cases of tympanic sepsis pure and simple, treatment by ionization alone is sufficient, and especially so if the perforation in the drum membrane is large enough to allow the introduction of the zinc solution and its distribution in sufficient amounts.

The technique of the treatment is very simple. The ear must be well cleansed and gently syringed with a warmed solution of zinc sulphate, containing one grain to the ounce of water, the patient lying with the infected ear up. The auditory canal is filled with the

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(7) Texas State Jour. Med., October, 1923.

zinc sulphate solution, a Seigel otoscope inserted, and gentle aspiration done to remove any air bubbles which may be in the tympanum.

It is necessary that one be provided with a direct current, either from dry cells, storage battery or a generator capable of delivering at least ten milliamperes of current when connected with the patient. The positive electrode, which is a short piece of zinc wire, is passed through a bit of glass tubing, provided with a rubber tip to make a tight fit in the external auditory meatus, which is filled with a warm solution of zinc sulphate. The negative pole, a moist sponge, is held in the hand of the patient. A current of three milliamperes is slowly turned on and allowed to flow for ten or fifteen minutes, and then gradually turned off. The external ear canal is not dried.

If there is a failure in what seemed to be a suitable case for ionization, and the discharge continues after the first real treatment, it is probably due to the fact that the perforation in the ear drum is too small to permit the zinc solution to enter, and at the next treatment the solution should be injected through the perforation with a small syringe, the procedure then being as before.

Acute Otitis Media and Mastoid Involvement. If one would properly understand suppurative ear conditions of childhood he should keep clearly in mind the anatomy of the temporal bone—a short description of which is given by J. I. McLallen[8].

The temporal bone is formed from three parts, the pars petrosa, the pars squamosa and the pars tympanica, which in the newborn are sharply separated by well-marked sutures. Of these the petrous is the most important as it contains the labyrinth and it is from the petrous bone that the mastoid develops. The tympanic bone in the newborn is but a shallow curved rim containing a groove, the sulcus tympanicus, for the

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(8) Atlantic Med. Jour., July, 1924.

attachment of the membrana tympani. The rim is incomplete at the upper pole, the cleft forming the incisura tympanica in which the membrane of Shrapnell is attached. The squamous bone in the newborn forms the outer covering for the recessus epitympanicus (the attic and aditus) as well as the outer covering for the antrum tympanicum. The roof of these chambers, the tegmen tympani et antri, is formed in part from the squamous bone and in part from the petrous. The suture passing directly through the tegmen is quite patulous in the newborn. This explains the ready occurrence in the young of meningeal symptoms in the cases of acute suppuration of the middle ear.

The outer surface of the temporal bone in the newborn presents an appearance quite unlike that seen in the adult. The most conspicuous difference is the complete absence of an osseous external meatus. The membranous meatus is connected to the shallow rim of bone, the pars tympanica, in which the membrana tympani is attached. This close relation between the membrana and the membranous external meatus accounts for the occurrence of pain in a young child whenever in cases of acute otitis media the auricle is manipulated. In older children this symptom disappears because the cartilage of the meatus is separated by a well-developed bony meatus from the area of infiltration about the attachment of the membrana tympani. The persistence of the petrosquamosal suture in children has an important practical bearing on the course of antrum infection at this age, as it permits of the rapid development of the subperiosteal abscess.

In the development of the temporal bone after birth the two conspicuous changes brought about are the formation of a mastoid process and of a bony external canal. The mastoid process develops largely from the petrous bone. It is first recognized as a small tubercle at about the age of one year. Its development takes place in two directions; outward, that is, external to the cavity of the tympanum, and downward below the cavity of the tympanum. It is the development of the mastoid process that causes the stylomastoid foramen to recede from the surface of the temporal bone until in the adult it lies fully 25 mm. from the outer surface of the mastoid. At the age three years the mastoid has already assumed the shape found in the adult and the digastric groove is easily recognized. The petrosquamosal suture has usually been obliterated with only occasionally a depression marking its site. The external bony covering of the antrum is still usually quite porous.

The following signs are indicative and should lead to examination: pulling the ear, rolling the head, temperature elevation (which may come from other causes), possible absence of pain, tenderness in front of the ear, sore muscles of the neck with lymph nodes; but the only true diagnostic sign is the reddened or bulging ear drum. Whenever we have rhinitis, pharyngitis, tonsillitis, or any of the contagious diseases, or in pneumonia after the child passed the critical stage and has a sudden rise of temperature, one should be sure to look at the tympanic membrane and generally a redness of Shrapnell's membrane will be found. While we have to consider the possible infection from the outside, the only safe measure is paracentesis under anesthesia.

The lips of the tubal opening are normally closed, and open only during the act of swallowing, when the levator and tensor muscles of the soft palate simultaneously open the tube and admit the amount of air necessary to counterbalance within the middle ear the outside atmospheric pressure working against the drum. Enlarged adenoids and tonsils interfere with the movement of these muscles and prevent the aeration of the middle ear, with a consequent thinning and gradual absorption of the air within the tympanum. A transudation of serum from the strongly filled vessels takes place, into which the bacteria from the usually highly inflamed adenoids are transmitted, and thus gradually suppuration is brought about. This is facilitated by the fact which was first demonstrated by Bezold, that due to the opposition of the tubal walls, the defensive and protective ciliated epithelium becomes destroyed and thereby the invasion of bacteria is made easier. A short survey into the literature will prove that adenoids and tonsils have been recognized as etiologic factors in acute and especially in chronic middle ear suppuration and that their removal has been strongly advocated, partially as a prophylactic against the acute form and also as a cure in the chronic one.

Temperature alone is not an indication for mastoidectomy. There is a period preceding the evidences of periostitis when intelligent scrutiny can detect in the meatus convincing evidence of mastoid inflammation, and this period is the time of election for operating. Periosteal swelling, as evident behind the ear, is too late an indication. The period is between the onset of the otitis and the stage of periosteal swelling. There will appear in the meatus reliable signs of beginning mastoid inflammation which careful scrutiny will reveal, and the appearance of these physical signs indicates the most favorable time and condition for operation. Furthermore, it is the author's belief that the welfare of the patient will not be prejudiced by deferring operative procedures until such changes in the meatus manifest themselves.

The two men that are dangerous in infections of the ear of the infantile patient are the one who is so careful with overcautious and dilatory conservatism that he exposes his patient to the dangers of intracranial inflammation, and the other who will drain an otitis media through the mastoid by operating on many preventable cases.

Summary. 1. A working knowledge of the temporal bone and the difference between the adult and the infantile type is necessary.

2. Traction on the external ear in the adult does not give pain when there is an otitis media.

3. Traction on the external ear, with an otitis media, does give pain when the patient is under two years.

4. Less than 2 per cent of the otitis medias develop an operative mastoid.

5. A reddened or bulging tympanic membrane is the only absolute diagnostic sign of otitis media.

6. An early crescent-shaped incision of the tympanic membrane under anesthesia, is a preventive treatment for mastoiditis.

7. Removal of tonsils and adenoids are a preventive treatment.

8. The time of election for mastoid operation will be revealed by signs in the external meatus.

Clinical Report of Treatment of Chronic Suppuration of Middle Ear by Ionization of Zinc. Unfavorable results following zinc ionization for suppurative otitis media are reported by M. C. Fox[9] as follows,—pain, eczema of the canal, tinnitus aurium or subjective noises in the head, vertigo during treatment and increased discharge. The pain is not generally felt during the first few treatments but gradually increases as the reaction develops.

By the reaction is meant that the drum and the exposed portion of the middle ear are seen to become red, then to turn to a grayish blue color which may last for three treatments, when all the surfaces begin to produce a scale which continues for a few days, clearing off in places and persisting in others. Until this scaling off is complete it can not be determined how much tissue is involved, for then the parts not ulcerated clear off, leaving a shiny red surface and the ulcers by this time have a granulating appearance.

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(9) Northwest Med., September, 1923.

The treatments are regulated as to interval, as well as duration and amount of current by the amount of reaction. At the beginning it is better to give a treatment every other day, commencing with 3 ma. for ten minutes, but some patients are not able to stand this amount, as in some of the subacute cases. If after two or three treatments there is no reaction, the time is increased to fifteen minutes, but the current is kept within 3 ma. As soon as the reaction begins, the time and current are reduced within the tolerance of the patient, but nearly always a treatment of ten minutes duration is given; the current may vary anywhere between 1/5 and 3 ma.

In some cases an eczema of the canal may develop at the time that the scale is being produced but this has given no trouble, as it soon cleared up under zinc oxide ointment when the peroxide has been omitted from the cleansing process.

Some of these old cases are troubled by tinnitus aurium or subjective noises, which are increased as the reaction is developed and may require some temporary treatment to endure sleep and rest. As the reaction subsides this treatment can be discontinued. Vertigo or dizziness is the physiologic response of a normal labyrinth to the galvanic current and is more active in some than in others, but can be controlled to a great extent by the rapidity with which we turn on the current. From two to four minutes should be consumed in reaching the maximum of 3 ma.

The discharge is stopped in nearly every case, following the first treatment, but begins again a day or two after the second treatment and increases until it is generally worse than it was before the treatment was begun. This causes a great deal of discouragement, alike to the patient and physician until he has learned to expect it.

At this time the sloughing takes place, if there is any, as happened in the tuburculous ear. In all ears the scales begin to appear and increase with the quantity of discharge and likewise the two subside, but the scales disappear first, leaving a smooth, shiny red surface where it is healed and a granulating surface over the ulcerated portion, which gradually closes in from all sides, healing under a dry scale which, when removed, leaves a shiny red surface as above described.

Technic. The ear is cleaned thoroughly with dry cotton-tipped probes, being sure to remove all the pus from the walls, thus exposing them to the action of the zinc sulphate solution. When this is done we fill the ear with peroxide and allow it to foam up, then remove it with cotton. Often it is found that there is still more pus which has been loosened by the peroxide which can now be removed. Some ears can be politzerized to remove the pus more thoroughly from the tube and the tubal region.

After drying all the surfaces with cotton, boric alcohol is applied, which is followed by filling the ear with a 1 per cent. zinc sulphate solution, in which is placed the positive zinc electrode in the center of the canal. This should be done with care, for without this precaution an ulcer will be produced at the point of contact.

The patient's hand is placed in a container of water, to which is attached the negative pole. The galvanic current is now cautiously turned on to produce the same result. The effect seems cumulative and as the treatment goes on we may have to turn back rather than advance. It is found that it is better to advance very gradually, keeping well within the tolerance of the patient, for in this way we are able to use more current than when this precaution is not taken. When the ear is once started to aching we can not increase the current but must turn back.

As the sensations during treatment are described differently by different patients, it is hard to give a fast rule. The best description is given by a patient who is a doctor, who has an involvement of the left ear. He states as the current begins, the sagittal canal being the first to respond, he seems to tip forward and as the current is increased the horizontal is the next to be stimulated, causing him to seem to roll to the left. From now on the sensations are not so definite and instead of turning endwise, as should be expected, he seems to wobble from side to side until he comes to rest, when the current is no longer increased. The whole train of sensations is repeated in the inverse order as the current is reversed and continues for some time after the current has been shut off.

Another patient describes it as a slight burning, gradually expanding in all directions and, if caution is not used, this becomes a severe pain, radiating over the whole side of the head and into the jaws and neck. At the height of the reaction this pain persists for hours after treatment, as was experienced by the patient with the tuberculous ear, in which case a very heavy dosage was being used in order to produce a reaction.

Still another patient describes the sensation of tickling and does not complain of burning or dizziness. In some the vertigo increases with the number of treatments, while in others the opposite result is obtained.

One of the factors governing the success of this treatment is the size of the perforation. An ear with a small perforation, which would prevent the thorough cleansing of the walls and likewise prevent the zinc solution coming in contact with the diseased surfaces, will show little or no improvement from this treatment.

Infected tonsils, adenoids, infected sinuses, mouth infections, carious teeth, etc., which would be quite sure to reinfect the ear, will of course hinder the treatment. If these conditions exist, they should be removed before we can expect much result from this or any other treatment.

Ether Treatment of Chronic Suppurative Otitis Media. In the treatment of chronic suppurative otitis media E. G. Galbraith[1] uses ordinary sulphuric ether.

When a patient with a chronic ear presents himself for treatment the first thing to do is to take a careful medical history, special attention being given to the onset and subsequent course of the suppurative process and what measures have been taken to control it. This completed, he is then given a thorough general, and ear, nose and throat examination, usually leaving the bad ear to the last. In most instances the external auditory canal will be found filled or partly filled with pus and foul smelling débris. This is best removed by syringing, but once the ear is clean this is never repeated. A hearing test is now made to determine the degree of deafness in the affected ear. Should aural polypi be found they are removed by whatever method best suits the case. If any contributing causes, either general or local, are found they are corrected. If polypi have been removed, nothing further is done until the reaction incident to their removal has subsided. If none are present and all contributing causes have been taken care of, we are ready to proceed with the treatment.

The patient is placed on his side with the affected ear up and the external auditory canal filled with ether such as is used for anesthetic purposes. He is allowed to lie in this position until all the ether has evaporated and none runs out when he assumes the sitting position. This requires from 10 to 15 minutes, depending on the size of the canal. The ear is then examined again and whatever débris or discharge may be present is wiped away with cotton on an applicator. This is repeated daily a few times or twice a day if the discharge is profuse. The patient is then given a small bottle of ether and a dropper and directed how to clean the ear by using cotton on an applicator,

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(1) Ohio State Med. Jour., December, 1923.

following which he is to use the ether as described above once or twice a day as indicated. At stated intervals he is to report for inspection and a new supply of ether.

Many favorable cases will show a marked improvement within a week's time. The odor will be less offensive and the discharge less profuse. Others will require a much longer time.

After this treatment has been described there are two questions that are almost invariably asked. Is it safe? Is it painful? To the first the reply is that it has been used over a period of four years and in all types of cases and in not one have any untoward symptoms developed. To the second question the answer is "yes," but in no case has it been so severe that it was felt necessary to discontinue it. What pain there is, is of short duration and subsides long before the ether has entirely evaporated.

When one stops to consider the chemical and physical properties of ether he finds them to be such as to make it admirably suitable for getting at and clearing up a chronic suppurative process located in a more or less inaccessible place such as the middle ear. It is a powerful solvent of lipoids which are to be found in the débris of a chronic ear and by this action the discharge is converted to a thinner liquid, thus making its escape more easy. It boils at 95° F., which is just a few degrees below body temperature. This means that soon after it is poured into the external auditory canal its temperature is actually raised to its boiling point and a gentle boiling of the liquid can be seen taking place. This property together with its solvent action probably constitutes its chief value in the treatment of this condition. By its solvent action one can easily conceive of its gaining access to small crevices which could not be reached by syringing. Soon after it is there the heat of the body raises its temperature to the boiling point and the agitation resulting from the boiling loosens and brings away particles that are preventing free drainage. That such a thing actually occurs can be seen by any one who on examining a canal that had been thoroughly cleansed before the instillation of the ether will find it practically covered with small particles of débris after the ether has all evaporated.

While it is probably of minor importance, ether has a definite germicidal action. It is known that it will kill the weaker organisms and it is not unlikely that its prolonged contact with the more resistant ones will render them less virulent. It is also highly probable that it has a stimulating effect upon the tissues with which it comes in contact, thus increasing their resistance to infection.

The water content to ether is one-tenth of one per cent. This means that when the ether has all evaporated it leaves practically a dry cavity. This is highly desirable for it avoids waterlogging the already edematous mucous membranes.

Chronic Aural Discharge. J. G. Gallison[2] differentiates between a clinical cure and an anatomic cure of chronic suppurative otitis media. A clinical cure simply stops the discharge and causes the condition to become latent, subject to reinfection with each succeeding pharyngitis. On the other hand, an anatomical cure cannot be said to have been effected until there is a complete dermatization of the promontory and all exposed areas, extending up from the otitic opening of the eustachian tube, or complete restoration of the drum membrane. To effect either of these conditions a complete eradication of the granulation tissue is necessary. Where the restoration of the tympanic membrane is possible, this, together with a healthy renewal of the epithelial lining of the middle ear will be sufficient. Where the destruction of the drum membrane is so extensive that its integrity cannot be restored there

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(2) Laryngoscope, January, 1924.

must be a destruction of the columnar and cuboidal epithelium lining the tympanic cavity, together with all the mucous and serous glands present, with a simultaneous extension of the squamous epithelium from the external auditory canal over the exposed areas. That is, the space that forms the remnant of the midle ear must be left in such a condition that there is no possibility of the secretion or collection of fluid. The resultant scar must remain absolutely dry. This is the ideal sought in performing a radical mastoid operation. At the same time the bacterial flora present in the midle ear and attic must be eliminated or reduced to a minimum, as epithelization occurs most rapidly on sterile or near sterile surfaces. It is also desirable but not absolutely necessary that the otitic end of the eustachian tube be healed off by cicatrization and adhesions, so as to separate completely the pharynx from the middle ear space. This is what has happened in the occasionally seen otitis media purulenta residual. A less complete eradication of the pathological process than here described cannot be claimed as an anatomical cure.

The author finds great benefit from the following prescription:

Phenol (95 per cent.)	gtt. xv.
Tincture iodin	gtt. xv.
Alcohol	ʒ iv.
Water, qs. ad.	℥ j.

If a free discharge of pus is present the patient is instructed to irrigate the ear once or twice a day with boric acid solution, as the condition may indicate. After irrigation the patient very carefully dries the ear with cotton wound on a toothpick and about five drops of the prescription above are placed in the ear and allowed to remain there for five minutes. As the purulent discharge decreases in amount the irrigations are discontinued as soon as may be. Otherwise the treatment is continued long after the ear seems to be dry, in order to be sure that there are no latent foci remaining.

In some cases there seems to be an idiosyncrasy to some drug in this combination—probably the phenol—and a watery edema ensues which makes the patient's tinnitus worse without a compensating improvement in the purulent condition present. In other cases this combination seems to be unduly irritating. With other patients psychic reasons may make it desirable to use "something different." He then uses the following prescription:

Mercurochrome—220	1 gm.
Water	70 cc.
Glycerin	30 cc.
Alcohol	100 cc.

Dissolve the mercurochrome-220 in the water, then add the glycerin and then the alcohol. This makes a solution that is even more permanent than a watery solution and at the same time meets all the requirements for use in running ears. These drops are used exactly as are the above drops of phenol and iodine, and in fact are a good substitute for them. However, unless improvement is prompt and continuous persistence in the use of mercurochrome-220 is not justified. The objection to their use lies in intense stain they produce in the skin and linen. The instruction for the removal of this stain, as given out by the manufacturers, is rather complicated and liable to irritate a delicate skin. Dilute acetic acid—common vinegar is a very efficient agent in the removal of these stains, and this renders the use of mercurochrome-220 much less objectionable. This drug must not be used in watery solution in chronic running ears, as it is precipitated out of solution and forms solid plugs in the fundus of the canal.

Acriflavine is directly soluble in 50 per cent. alcohol, or it may be dissolved in water and later diluted with alcohol to the desired strength. It produces an intense yellow stain of the skin that is objectionable. This may, however, be removed by the use of household ammonia, as the acriflavine is constructed on an acid base. Up to the present time it has not been tried on a sufficient number of cases to form a final judgment as to its value. It is also possible that it was used in too strong a solution. This was a strength of 1 to 500. In some of the patients the results were most satisfactory, the ears progressing rapidly to a cure. However, this drug is very irritating to the skin in the strength used, and there is a strong tendency to the formation of persistent eczematous conditions. It is probable that higher dilutions, as 1 to 1,000 or even 1 to 2,000, would overcome this difficulty. Further trials will be made and the results presented in a later report. For the present, acriflavine should be used with great caution.

The author offers the following conclusions. 1. Chronic aurual discharge is in most cases a curable condition. Silver nitrate and trichloracetic acid are available for the destruction of the granulations; and phenol, tincture of iodine, mercurochrome-220 and acriflavine for the continued antisepsis of the ear.

2. The performance of the radical mastoid operation is not justified until a prolonged effort has been made to cure the discharge, except in the presence of a cholesteatoma or an acute exacerbation that immediately endangers the life of the patient.

3. The hearing can be much improved in these patients after the discharge has been cured by appropriate medication.

4. The utmost patience and persistence is justified in the treatment of aural discharge, the reward therefor being a cured ear with improved hearing in patients who are progressively becoming worse, and many of whom later will not be able to earn a livelihood.

THE MASTOID AND SINUSES.

Acute Mastoiditis—Its Prevention and Treatment. In mastoids which are fully developed C. B. Taylor[3] thinks the *x*-ray gives valuable information.

It is almost universal that if in the development of the mastoids any one of the three types—sclerotic, diploic or pnuematic—obtains on one side it will obtain also on the opposite side.

In our history getting it will be well to learn if there has been an old mastoid involvement in either side which might have left an eburnated bone that might be confused with a normal sclerotic type. This must necessarily be taken into consideration in a comparison of the two sides.

But in case there has never been a previous involvement of either side and we have one side now acute and are suspicious of a decided involvement of the cells, an *x*-ray of both mastoids carefully read and compared will tell, in almost every instance, the degree of involvement.

The readings are not so satisfactory in the sclerotic as in the diploic and pneumatic types. This is self-evident as in case both mastoids are normally heavy an infection will not increase much their density. But it is seldom that the bones are normally so dense throughout that an involvement with pus and its concomitant destructive processes will not manifest itself in a changed picture.

Sometimes the major portion of the mastoid is sclerotic or diploic, but a large tip cell is present. But if a large tip cell is present on one side it will most likely

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(3) Jour. Iowa State Med. Soc., February, 1924.

be present on the opposite side. An *x*-ray shows the suspicious side dark at the tip while the well side shows a large pnuematic cell.

Studies of Mastoid Disease by X-Rays with Operative Findings. The first essential in the roentgengraphic examination of the mastoid, according to G. E. Pfahler,[4] is the making of good films, which will show the finest possible details. The second essential is skillful interpretation, and the third essential is the correlation of the *x*-ray evidences with the clinical symptoms. Insofar as any of these three are lacking, there will be failures.

1. The patient's head must be absolutely fixed. He accomplishes this with sandbags.

2. The central ray should be passed directly through the auditory canal. This he has been able to accomplish by means of a special localizer. Briefly, it consists of a head rest which permits him to fix absolutely the external and auditory meatus in direct relation to the tube holder, so that the two sides of the head can be examined exactly the same and any two heads can be examined alike. The central ray is passed obliquely from above at an angle of 10 degrees, and posteriorly at an angle of 15 degrees. This makes the central ray enter the proximal side of the head about 1½ inches above the external auditory meatus about 13 inches posteriorly to the external auditory meatus. The films may be made stereoscopically, as is recommended by Allen and others. He does not make stereoroentgenograms routinely because this of necessity changes the direction of the central ray. In certain special cases stereoroentgenograms are of advantage.

3. Sharpness in detail is improved by the use of a small cylinder diaphragm. He uses one cylinder 3 inches in diameter at the surface of the head and then makes a second film on each side with a cylinder 1¾ inches in diameter. Such small diaphragm work is only possible where an exact localizer is used.

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(4) Laryngoscope, May, 1924.

4. The duration of the exposure will vary with the individual technic. He uses super-speed films, double screens, a 3½ or 4 inch parallel spark gap, and 4 to 6 seconds exposure.

In addition to the positions described above, one may often get special information with regard to the tip of the mastoid by directing the central ray through the mouth toward the tip on the opposite side. In whatever position, both mastoids should be examined and compared.

Sometimes additional information may be obtained by oblique exposures, either projecting the shadow of the skull forward, by directing the central ray from behind and from below, or one may project the cells into the occipital region by directing the central ray from above and anteriorly to the petrous portion of the temporal bone on the proximal side. This position will project the dense petrous portion below the level of the antrum.

Concluions. 1. The *x*-ray examination should be a part of the routine study of each case of mastoid disease.

2. In all instances the evidence should be correlated with the clinical evidence of disease, especially in deciding upon operation.

3. Success depends first upon skillful technic in making fine roentgenograms, and secondly, in careful observation and interpretation.

4. The two sides should always be examined, and generally compared but they are not always symmetrical and interpretation must often be made independently of the opposite side.

Studies of Mastoid Disease by X-Rays, Etc. M. S. Ersner[5] attempts to state what clinicians should expect from the *x*-ray in mastoid diseases.

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(5) Laryngoscope, May, 1924.

1. Comparative study between the normal and the diseased mastoid. (Both mastoids are usually developed alike and any deviation from the normal will be divulged by the *x*-ray plate.)

2. Type of mastoid, whether pnuematic, non-cellular or sclerotic.

3. Topographical and regional anatomy of the mastoid, its cellular distribution, type of cells, position of the sinus and its surrounding area.

4. In atypical mastoiditis the *x*-ray is indispensable as an aid in diagnosis.

5. Cavity formation.

6. Prognosis is often made by consecutive *x*-ray studies. (A mastoid with large cells may undergo resolution without operative interference as the drainage in such mastoid is not impeded as frequently as in the other mastoïd types.)

7. Prognosis of peri-sinus abscess.

8. Epidural abscess diagnosed.

9. Bilateral suppuration.

10. Sclerotic mastoid.

11. In children where the cells are not fully developed, a roentgenologic diagnosis may often be made when the antrum is located as there are a few cells invariably present there.

After a study of 142 *x*-ray cases of mastoid disease the author arrives at the following conclusions.

1. *X*-ray is indicated as a routine whether the diagnosis has been made or not, so as to correlate clinical and operative findings.

2. It is important to cleanse the area to be *x*-rayed as ointments used as medicaments may contain some metallic substances which will produce pseudo shadows.

3. Some atypical cases probably would never be diagnosed without an *x*-ray where there was no middle ear suppuration and at operation an extra-dural abscess was found.

4. *X*-ray in the author's experience has always been very helpful and at no time was he inclined to operate unless the clinical symptoms warranted such procedure.

5. The mastoid pathology can be watched as to progress by means of *x*-ray at three-day intervals

6. Those who are following the conservative treatment in mastoid therapy will bear in mind that it is important to keep vigilant watch on the lateral sinus. Should there be any signs of haziness or complete loss of the lateral sinus from view, we may suspect necrosis of the anterior bony wall with a peri-sinus abscess.

7. It is especially important for the novice beginning to practice in the specialty to take routine *x*-rays as he may learn the topographical and regional anatomy of the mastoid, as to type, whether cellular or non-cellular and position of the lateral sinus.

8. The angle from which the mastoid picture is taken must be understood as otherwise the clinician will misinterpret some of the shadows.

9. Cavity formation appears as a blurred area without septa and the edges of the cavity are not distinctly visible. This must be differentiated from a large normal cell which is irregular in shape, the edges of which are distinct and sharply outlined with septa intervening.

10. In order to obtain good pictures in children, a few whiffs of chloroform should be administered.

11. In children where cells are not fully developed, the author always studies the plates along the posterior canal wall, as in this area the bone is thickened and the antrum has one or two cells and if there is any disease it should be seen there.

12. In mastoid disease always *x*-ray both mastoids and compare the normal side with the diseased. In most instances the cellular distribution and general confirmation of the mastoids are alike and any deviation from the normal will readily be seen unless there is a history of previous middle ear suppuration.

13. In bilateral suppuration both plates should be studied, selecting the side to operate which shows most pathology from a clinical and radiographic standpoint.

14. The operative findings in one mastoid will usually interpret the plates of the opposite side and a decision as to the course of pursuit will be simpler.

15. It is the idea of many clinicians to *x*-ray all mastoids so as to correlate the *x*-ray with the clinical and operative findings. Although we may make our diagnosis in most cases clinically and judge whether operation is indicated or not, it should, however, be our aim to develop clinically so as to be able to outline the pathological conditions underlying the mastoid cortex.

16. Repeated *x*-rays will show whether the disease is at a standstill, progressing or undergoing sclerosis.

17. We must bear in mind that operations are often delayed after *x*-ray plates have been taken and radiographic studies must therefore not be condemned because they do not coincide with the operative findings.

Acute Surgical Mastoditits. The *x*-ray findings are very important when in keeping with the clinical finding, according to S. B. Cowen,[6] but should not be depended upon alone for a diagnosis. Both mastoids should be taken for comparison. When the status of the case is such that one calls on the *x*-ray for a decision whether to operate or note, mere cloudiness of the mastoid should not be the criterion but evidence of definite breaking down of the cell walls should be demanded.

Old healed processes may be taken at times for acute ones.

The *x*-ray also shows the extent of the mastoid and the position of the lateral sinus which is of considerable help when known prior to entering the bone.

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(6) Ohio State Med. Jour., January, 1924.

Indications for Surgical Intervention in Acute Suppuration of the Middle Ear. In formulating the indications for mastoidectomy P. D. Kerrison[7] gives the following:

1. Post auricular edema or subperiosteal abscess.

2. Definite mastoid tenderness, extending well beyond the limits of the antrum, and showing no tendency to diminution within 6 or 7 days following incision of the drum membrane.

3. Marked variations in the amount of discharge extending over a considerable period of time, the periods of maximum flow showing an amount of pus obviously too great to be of purely tympanic origin. Should this condition be accompanied by temperature variations, the higher temperature levels coinciding with the periods of diminished discharge, the indication for surgical relief would be further defined and emphasized.

4. Prolonged discharge from the ear, if associated with persistent and marked diminution of hearing, constitutes a valid reason for operating upon the mastoid. This statement is based on the need of surgical drainage as a means of safeguarding the hearing and in the large percentage of such cases which eventually call for surgical intervention as the surest, and in some cases, the only way of bringing about recovery.

5. The condition in which an inflamed and infiltrated drum membrane, after one or possibly repeated myringotomies, continues constantly to exude pus. We may cleanse the canal by any means at our command and then, as often as we wipe away pus from the region of the perforation, it is seen to drip almost drop by drop into the canal. It is a slow welling up of pus indicating an overflow from surcharged mastoid cells, and usually indicated the need of drainage through a mastoid operation.

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(7) Laryngoscope, November, 1923.

6. Fever is an inconspicuous symptom in many cases even of severe mastoid inflammation. During the course of any case of acute or subacute tympano-mastoid infection, however, a sudden change in the temperature or range—either in the form of a rapid elevation to high temperature or of a slowly mounting temperature curve—may constitute a valid reason for surgical intervention. It is understood, of course, that this indication would have weight only after careful elimination of other causes in intercurrent disease not of otitic origin.

In trying to formulate any rational statement of the indications for mastoid surgery, one is prepared to admit that under all or any of the conditions above outlined the patient, if he refuses operation, may yet recover completely. The aurist, however, is called upon to consider the following questions: (a) whether the patient's condition is such that prompt relief through post-auricular drainage is called for; (b) whether the physical changes in tympanic structures with evidences of pronounced functional loss call for surgical intervention for the conservation of hearing; and (c) whether the possibilities of intracranial invasion outweigh in any particular case the advantage of delay.

However careful one may be in formulating rules for operating upon the mastoid, there is yet another factor—not easily reducible to words—which nevertheless may modify the judgment of an experienced surgeon in regard to a particular case, and overrule the deductions usually to be drawn from certain signs or symptoms present. There is that indefinable something in the patient's general appearance or condition which in spite of fever or mastoid tenderness may indicate, or at least suggest, that the progress of the lesion is advancing favorably in one case and unfavorably in another. This is particularly true in the case of infants and young children. It is an intuitive inference based on the subconscious memory of many cases carefully observed. It councils delay in operating in certain cases which eventually recover wholly without operation. It proves untrustworthy in certain cases in which the need of surgical intervention subsequently becomes obvious; on the other hand, it saves many patients from the trials of a needless operation.

Mastoid Operations Under Local Anesthesia. In mastoid operations under local anesthesia, according to G. W. Boot[8], three things are essential; sharp gouges, light strokes of the mallet and a tractable patient.

The following may be considered as indications for local anesthesia in mastoid operations.

1. The presence of profoundly septic conditions such as occur in scarlet fever.
2. The presence of severe bronchitis or pneumonia, particularly when these occur in the course of measles.
3. The presence of pulmonary tuberculosis, where general anesthesia may light up or accelerate the tubercular process.
4. The presence of nephritis.
5. The presence of diabetes.
6. The absence of an anesthetist.
7. The objection of the patient to general anesthesia.
8. Old age where the general resistance to everything is low.
9. The presence of high blood pressure. Here adrenalin should be used with the novocain.

The contraindications to mastoid operations under local anesthesia are:

1. Nervousness of patients.
2. The need of the sinus to be opened, unless the operator knows that he can control alarming bleeding quickly and can keep his patient from becoming alarmed.

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(8) Illinois Med. Jour., November, 1923.

The results are just as good as in operations done under general anesthesia. The patient is not starved in advance, and he does not vomit or feel sick after the operation. The wound heals just as quickly as under any other method of operation. Acidosis is not increased by the operation. Operation under local anesthesia can be done at any age where a mastoid operation is indicated.

Indications for Mastoid Operations Under Local Anesthesia. P. S. Stout[9] gives the following list of special conditions which he considers require a local anesthetic for mastoid operations. 1. Age, under one year. The brain surgeons who are doing everything in their power to reduce the mortality have adopted this method. It is interesting to note here that the brain surgeons will soon be doing all their work for practically all ages under local anesthesia. 2. Tuberculosis of the lungs. No one can say they are willing to give ether or chloroform to a person with latent or active tuberculosis of the lungs. 3. In pneumonia, lung abscesses, chronic bronchitis, various asthmatic conditions, severe hay fever, bronchiectasia, and acute pleurisy. 4. Measles, scarlet fever, diphtheria, whooping cough, typhoid fever. 5. Goiter, or any other tumor or condition of the neck, trachea, or larynx that would interfere with general anesthesia. Acute tonsillitis, hyper-thyroidism, hypo-thyroidism, enlarged thymus, status lymphaticus. 6. Severe anemias from whatever cause. 7. Cardiac cases, aneurysm, phlebitis. 8. Cardio-renal, high blood pressure cases. 9. Apoplexy, epilepsy. 10 Renal cases. 11. Pregnancy. 12. Diabetes mellitus. 13. Alcoholics and drug addicts. 14. Brain conditions associated with mastoiditis such as brain abscesses, tumor, sinus thrombosis, meningitis, lepto-meningitis, sleeping sickness. 15. The presence of a great fear of general anesthesia. 16. Obesity, extreme weakness, advanced age.

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(9) Laryngoscope, November, 1923.

Atypical Mastoiditis. In order properly to appreciate atypical as well as typical mastoiditis, M. S. Ersner[1] makes the following suggestions.

1. A thorough history of the case is essential because we will learn the date of onset, suppuration if present, type and location of pain, and, if pus had been present, its date of cessation. It is important to know whether paracentesis was performed, and if so, how many times it was done, as three or four ear drum incisions should be looked upon with suspicion as indicative of mastoid involvement.

2. One should note whether the patient has any facial palsy, the position of the auricle, whether there is any fullness over the mastoid area, and closely observe the number of postauricular folds. (In the aged it is interesting to note the difference between the diseased side from the normal.) It will be observed that the diseased side will reveal a distinct smoothing of the furrows, while the normal side will be wrinkled.

A thorough examination of the middle ear, noting the quantity of pus, is most important. We know that whenever there is a great deal of pus present, it must come from some other source than the middle ear and that must be the mastoid. Observe the site of the perforation and resiliency of the ear drum. A nipple-shaped perforation, with sagging of the posterior superior canal wall, suggests mastoid involvement.

3. Observe the tender points, such as, over the antrum, zygomatic region, tip, and over the emissary vein. Also, ascertain the mobility of the skin and periosteum over the mastoid.

4. A progressive loss of hearing, with the history of otitis media, with or without suppuration, with vague pains over the mastoid, thickening of the periosteum over the mastoid, immobility of the skin and loss of postauricular folds should be watched carefully.

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(1) Atlantic Med. Jour., September, 1923.

5. The leukocyte count is significant. A high total leukocyte count is of no importance. It simply suggests resistance of the individual to the infection, unless some intracranial complications take place. A differential blood count with a high polymorphonuclear leukocyte count is pathognomonic of bone destruction and should be watched cautiously.

6. The *x*-ray is a great asset in our diagnosis of mastoid disease, but negative reports should be disregarded when the clinical symptoms are pointing towards mastoid involvement.

When children are radiographed, the author always suggests to the radiologist that a few whiffs of chloroform be administered, so as to obtain good pictures.

Mastoiditis Without Apparent Involvement of the Middle Ear. Three cases of mastoiditis without apparent involvement of the middle ear are reported by B. E. Hempstead[2]. The writer refers to many cases found in medical literature and offers the following summary of his three cases.

It is recalled that in the second and third cases there was a history of an antecedent pain in the ear which disappeared without treatment in a very short time; in fact, in Case 2, it was said to have been an hour. The symptom which called attention to the mastoid was the swelling over the mastoid process. The indolent type of infection, and the slow breaking down of the septums of the cells into a large cavity, followed by the formation of the subperiosteal abscess, could explain the absence of pain as a prominent symptom. The anatomic conformation of the mastoid process may have been a factor, because the antrum and aditus were found to be very small. It seems evident that these cases could not be grouped in those of blood-borne infection.

In all cases the middle ear structures and the tympanic membrane were negative to physical examination.

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(2) Jour. Amer. Med. Ass'n., Oct. 13, 1924.

In the second case there was noticed a marked fulness of the superior canal wall externally to the isthmus. One usually expects to encounter drooping beyond the isthmus.

While the study of these cases of mastoiditis without involvement of the middle ear does not permit definite conclusions, it indicates the existence of an antecedent otitis media without symptoms.

[While many cases of mastoid disease occur without accompanying or preceding otorrhoea it is always possible, usually probable, that the infection reached the mastoid through the eustachian tube and middle ear. —Ed.]

Atypical Mastoiditis. T. E. Hughes[3] reports another case of mastoid abscess without recent discharge from the ear. The patient may have had a slight discharge a year and a half before with slight mastoid symptoms but the recent attack began with no symptoms premonitory to the postauricular swelling. In operating there was found an abscess cavity (subperiosteal) over and behind mastoid tip, containing several drams of pus, from which culture showed staphylococcus aureus. A large fistula was found extending through the digrastic groove into the mastoid tip, which was completely hulled out by necrosis of cellular structure. In the upper portion of the mastoid, the cells had been replaced by sclerosed bone, by which the pus in the tip was walled off from a practically normal antrum. The lateral sinus plate was necrosed from just above the bulb upward toward the knee for one-half to three-fourths of an inch. Sinus was apparently healthy. Patient had an uneventful recovery, and the wound was healed in about three weeks.

Summary and Conclusions. 1. The patient probably had a mastoiditis a year and a half ago, though with considerable doubt as to whether or not there was involvement of the middle ear.

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(3) Laryngoscope, September, 1924.

2. During present illness a mastoiditis due to a staphylococcus aureus with much pus and considerable cell destruction in the tip and with practically no pain and without involvement of the tympanum.

3. Bony sclerosis between antrum and the infected area.

4. Blood culture negative.

The question naturally arises whether we are dealing with an idiopathic, or primary mastoiditis, or a latent condition that has existed for a year and a half without giving signs or symptoms.

The author thinks there was a low grade, quiescent, rather than a primary infection, in view of the fact that we have a negative blood culture and no evident source of infection necessary for a metastatic process. The absence of infection in the mastoid antrum and tympanum might be explained by the fact that the sclerosis, produced by the inflammation a year and a half ago, prevented the extension of the infection upward into the antrum.

Acute Mastoiditis Without Aural Discharge. Another case of mastoid abscess without aural discharge is reported by C. R. King[4].

Five weeks prior to examination, the patient had an acute bilateral tonsillitis, and two days later, earache in the left ear developed, continuing intermittently for three days. The tonsils then flared up again, and the earache returned in two or three days with greater severity, accompanied by pain in the left mastoid region. One week after the second onset of earache, she noticed some swelling over the left mastoid, and this varied in extent from day to day. During this time and until the day of examination she suffered much earache, but there never was any aural discharge. She stated that at times she had a peculiar taste in her throat ''as though it were blood or something.''

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(4) Jour. Amer. Med. Ass'n., Nov. 3, 1923.

A large postauricular abscess formed which was pointing in several places. An incision was followed by the immediate escape of about 4 ounces of yellowish green pus under pressure. The periosteum was retracted, and at first glance the mastoid cortex appeared normal. Closer inspection quickly revealed a small black spot of bone about 4 or 5 mm. behind the auditory canal. This spot was about 2 mm. in diameter, and was a cell full of necrotic tissue, which was curetted away; all adjacent cells were curetted free of granulation tissue with a small amount of thick pus. The antrum was found far posterior to the tympanum, and deeply situated. It was cleared of necrotic tissue. The tip cells were thoroughly explored, but apparently the infection had been walled off before they could be successfully invaded. The mastoid wound was flushed out with a mixture of alcohol and hydrogen peroxid, and iodoform gauze drain inserted, and the wound closed in its upper half. The drum head was incised. The culture showed that the pneumococcus was the active infecting agent. The temperature, which on admission had been 101, dropped to normal the next day after operation and remained so.

On the fifth day, the middle ear was dry, and the wound looked healthy. The wound discharged moderately for two weeks, after which healing was very rapid.

Tenderness in Acute Mastoid Disease. As the most important indication for a mastoid operation in acute purulent otitis media, Macleod Yearsley[5] names *tenderness on pressure* over the site of the antrum, at any spot on the anterior border of the mastoid, or at its tip. It is generally the first symptom to be present and is the indication, par excellence, for opening the mastoid without delay. The longer a patient is allowed to carry pus in his mastoid antrum or cells, the greater is the danger to both life and hearing.

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(5) Practitioner, April, 1924.

The indications for operation in acute mastoiditis are given with fair consistency in the text-books, and may be summed up as follows.

1. Mastoid swelling, with tenderness on pressure, and fever.
2. Persistent tenderness, even after the subsidence of acute symptoms.
3. Supra-meatal bulging; that is, a sagging of the posterior-superior meatal wall close to, and partially obscuring, the tympanic membrane.
4. A continuance of discharge, mastoid pain, and fever, after abortive treatment has been attempted.
5. The occurrence of chills, nausea, and meningeal irritation.
6. The presence of streptococci in the pus.
7. When a simple blood-count demonstrates the presence of leucocytosis, and the polymorphonuclear percentage is above normal.
8. The presence of a shadow on *x*-ray examination. This is a useful confirmatory sign to those whose caution will not allow them to depend upon one symptom.

With this formidable list, it is scarcely surprising that the general practitioner is led sometimes to temporize. If he sees his patient when the first of these eight indications is already present, hesitation is absolutely unjustifiable. If, however, he finds merely pain on pressure, there may be a considerable temptation to wait further symptoms.

As a matter of fact, all these indications are as nothing in the face of tenderness, and to wait for the appearance of any of them is to temporize, and to temporize is, in nine cases out of ten, to court disaster.

Temperature is a most illusive guide, especially in post-influenzal cases. Fullness behind the ear, redness, and the formation of an abscess over the mastoid may occur, but only when the case has been allowed to advance too far. They are distinctly not symptoms for which to wait.

It is the *mastoid tenderness* which is so significant and so valuable a guide in prognosis and treatment. The method of eliciting the symptom is not without importance. It is not sufficient to make indiscriminate pressure with the finger and ask "if it hurts." The examination should be made without reference to the patient's account of his sensations. While conversing with him as to the onset and course of his illness, systematic pressure should be made with the thumb over the whole mastoid process, beginning with the site of the antrum and passing to the anterior border and the tip. At the same time, while keeping the patient in conversation his eye should be watched carefully; tenderness will be at once indicated by an involuntary spasm of the eyelid and orbicular muscle.

Once the presence of pain on pressure over the mastoid is established, operation should be undertaken with as little delay as possible.

[The presence of normal tenderness over the mastoid should not be forgotten as there is always a sensitive spot even in the healthy mastoids just back of the auditory canal.—Ed.]

Two Hundred Cases of Mastoid Surgery. Two hundred cases of mastoid surgery are reviewed by M. F. McCarthy[6]. Some of the cases were private, some occurred during service in France and some in the American Military Camps. He offers the following conclusions.

1. The mortality rate of simple mastoid drainage where no complications were found at time of operation was much higher at Camp Taylor and Camp Sherman during the period of 1917-1918, than in private practice before or since the war. The only suggestion the author has to offer in explanation is that during that period he was dealing with a streptococcus of marked virulence, which showed a marked tendency to attack the meninges.

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(6) Cincinnati Jour. Med., March, 1924.

2. Meningitis of otic origin is rarely the result of direct extension from the mastoid structure, except as it occurs through thrombosis of the lateral sinus.

3. Post-operative meningitis did not occur in any of this group of cases where the dura was exposed and the author believes that a small or crack exposure of the dura is more dangerous than a large exposure, where pus is present.

4. All pre-operative cases of sinus thrombosis in this series were thrombosed in the sigmoid portion of the sinus and never at the knee. In all these cases thrombosis resulted from extension from the infected and breaking down cells of the posterior lower portion of the mastoid cell structure.

5. Post-operative lateral sinus thrombosis is practically always followed by recovery, if homolateral internal jugular ligation is done promptly.

6. Pre-operative lateral sinus thrombosis has a higher mortality rate than post-operative lateral sinus thrombosis, at least in this series of cases.

Causes of Persistent Otorrhea after a Simple Mastoid Operation. The causes enumerated by F. P. Emmerson[7] are as follows.

1. Perhaps no one cause is more frequently met with than lack of surgical judgment in the after-care of a mastoid operation. No technic that the writer has observed is more efficient than that practiced at the Massachusetts Charitable Eye and Ear Infirmary for the last fifteen years. The external dressing is changed daily, if saturated or stiff from dried blood, and the wick changed in the external canal under strict aseptic precautions. The mastoid packing is removed on the fourth to the sixth day, and a single wick is carried up to the aditus daily until the tympanic suppuration ceases. The bone cavity is then allowed to heal by organization of the blood and exudate without more drainage. Occasionally the lips of the external

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(7) Ann. Otol., Rhinol., and Laryngol., March, 1924.

wound are opened with a probe to allow the escape of serum. If control of the aditus is not rigidly carried out until the tympanic suppurative ceases an otorrhea may continue indefinitely.

2. Too early removal of the mastoid cortex before the infection has been limited by a leukocytic barrier. This was much more frequent before the days of the *x*-ray than at present. Unless the surgeon, however, has had a large operative experience his anxiety will lead him to operate while the bone infection is active and has not become limited by nature. Very rarely is it necessary to interfere surgically before a week from the time of an early incision of the membrana tympani.

If all diseased bone is not removed the otorrhea continues. To get the best results, then, it is necessary to know when to operate in order to have the assistance of nature when the patient's resistance is best.

3. Incomplete exenteration, especially of the deep layer of posterior canal cells. (It is taken for granted that we are discussing the procedure usually carried out in this country of opening the antrum in all cases.) If we remember that it is a straight line from the antrum to the tip cell this should rarely happen. Any mounding up between these points may mean that there are cells beneath that should be uncovered. Next to the posterior canal cells are one or more cells in the zygoma which are frequently overlooked.

4. Too active surgery in the region of the aditus delaying the walling off of the middle ear and exposing the mastoid cavity to reinfection. While unhealthy granulations and necrotic bone should be removed here, as elsewhere, this should be done with a clear appreciation of what is necessary and what may be too radical surgery.

5. The active symptoms referred to the middle ear and mastoid and the necessity of operating upon a terminal process sometimes lead us to forget where the

infection started. It is conceded that an infection virulent enough to cause an acute purulent middle ear and mastoid usually involves the paranasal sinuses and lymphoid tissue of the nasopharynx. The focal process may reinfect the middle ear and mastoid during the healing process and increase a discharge that was gradually diminishing.

6. Persistent otorrhea from arrested tissue repair may occur as the result of the poor resistance of the patient requiring general and local treatment. Stimulation locally may be carried out by the use of iodin-iodoform-balsam of Peru, etc., and necrotic bone tissue may need to be curetted. This should be done promptly if we are to succeed in walling off the middle ear in the required time. The patient's general condition should be fortified by tonics, forced feeding and fresh air. Every resource of the surgeon will be necessary to bring about normal healing, and the daily dressing should not be trusted to inexperienced hands. There are a certain number of cases where patients seem to have lost all power to react against certain type of infection.

7. Osteomalacia. This complication is fortunately rare, but when present is one of the most difficult to deal with.

8. General systemic conditions due to syphilis or tuberculosis. Lues in the eustachian tube or Rosenmueller's fossa may be the cause of a persistent otorrhea. Tuberculosis may cause unhealthy tissue repair or the formation of sequestra, especially in children.

Mastoid Bandage. G. M. Coates and B. H. Shuster[2] suggest the following form of mastoid bandage. With the mastoid dressing in place, a strip of gauze bandage, about a yard long, is placed over the head in the vertical line, beginning below the tip of the nose, with the tail hanging midway between the shoulders. Another piece of gauze two feet long is placed under the chin and tied loosely with a single knot on the middle

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(2) Laryngoscope, December, 1923.

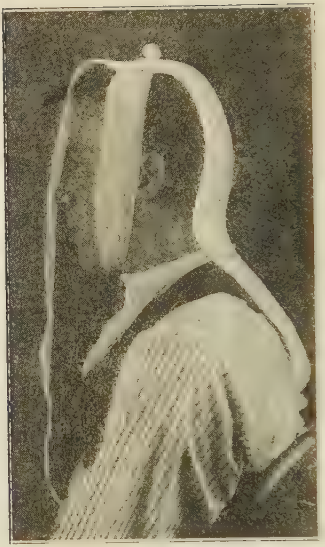

Fig. 10.—Mastoid bandage.

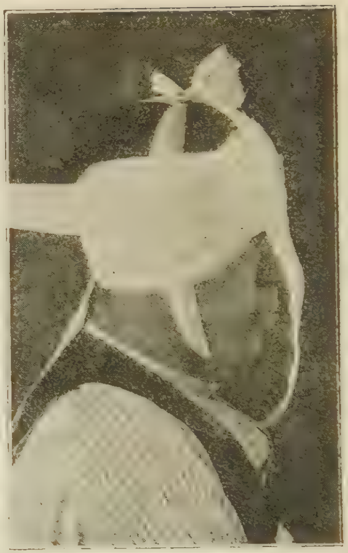

Fig. 11.—Mastoid bandage.

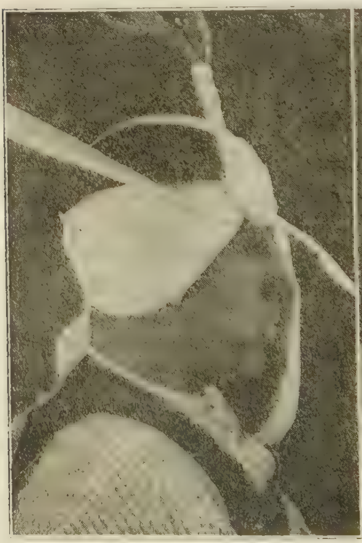

Fig. 12.—Mastoid bandage.

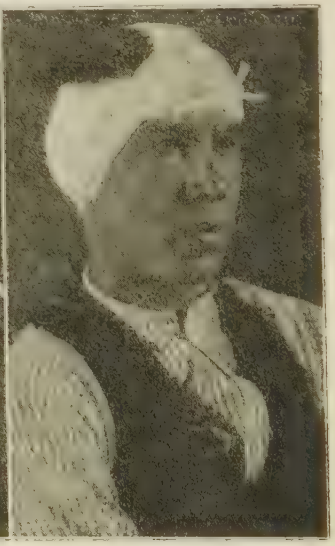

Fig. 13.—Mastoid bandage.

of the top of the head. The remainder of the bandage is now used to hold the dressing in place, being applied in the usual way, but without reversing, care being taken to place it smoothly and to cover both the upper and lower limits of the gauze dressing. It must not be applied tightly, however, and not very many turns are needed. No care need be exercised to keep it away from the eyes as is usual in this form of bandage and wherein the greatest difficulty is often encountered. When this part of the bandage has been applied to the satisfaction of the dresser, the second piece of bandage is cut beneath the chin and untied at the top. We now have two short strips of bandage, passing under the circular bandage at about the outer canthi of the eyes. Each of these strips is, in turn, tied over the forehead turn of circular bandage, thereby lifting the latter away from the eyes and eyebrows, tightening them and making the whole bandage firm and secure. The loose end of the circular bandage is now tied to one of these loose tails. A bandage properly applied in this manner can be dislodged upward only with considerable difficulty. But it can still be pulled downward over the eyes. To obviate this, the two ends of the vertical strip are now tied on top of the head. This prevents the bandage slipping or being dislodged downward. The knot must be well toward the top of the head so that it will not cause discomfort by pressing on the skull when recumbent, no matter in what position the patient lies. All the loose ends of bandage are now cut away with scissors.

Etiology and Diagnosis of Lateral Sinus Thrombosis. In a discussion of intracranial complications of otitis media S. MacCuen Smith[3] states that on the appearance of intracranial symptoms in a patient in whom the presence of the tubercle bacillus has been definitely established, whether in the bones, joints, glands, lungs or bowels, tubercular meningitis is the lesion to be

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(3) Atlantic Med. Jour., June, 1924.

suspected, even though symptoms of sinus thrombosis may be prominent. This statement has been verified by post-mortem findings. On the other hand, on the appearance of intracranial symptoms during an attack of pneumonia and other non-tubercular pulmonary diseases, as well as severe endocarditis, brain abscess should be suspected; but if the primary disease has been one of the acute infections, as influenza, measles, scarlet fever, etc., suppurative meningitis or sinus thrombosis is likely to be the causative factor.

The most frequent site of lateral sinus thrombosis is the sigmoid portion, more particularly at the knee, the next most frequent site of an initial lesion being the bulbous portion. If the involvement is rapid, it progresses directly through the small blood vessels penetrating the osseous structure, as is usual in all marasmic and allied conditions, and in such cases the infection may start at any part of the sinus. So long as the cloth remains sterile, localizing symptoms may be wholly absent. Unfortunately this sterility does not prevail for any great length of time and if the sinus is suspected of involvement one should be ready for an immediate operation when disintegration begins in order to obtain the most favorable results.

Although some form of streptococcus, in recent years notably the streptococcus hemolyticus, is the usual microorganism found, the writer's own experience leads him to the conclusion that the pneumococcus is almost as often present. We should bear in mind also the insidious action of the bacillus mucosus capsulatus. Although presenting few symptoms in the initial stage, this is ultimately one of our most formidable foes.

Our chief object should be to establish an early diagnosis but this is obviously quite impossible in most instances, the atypical cases seeming to become more frequent of late years; and yet to await the development of the classical symptoms is unquestionably to court disaster. The diagnosis in advanced, uncomplicated cases is not in any sense difficult and the condition should be readily recognized. At present it is impossible to differentiate between pyemia not secondary to sinus thrombosis and that resulting from it, in the absence of contributory symptoms. However, the former is exceedingly rare and we must, therefore, assume that the sinus is diseased in some doubtful but urgent cases and proceed accordingly. Given a case presenting rigors, oscillating temperature at more or less regular intervals, enlarged posterior cervical glands, localizing pain over the mastoid process, the emissary vein and along the course of the jugular vein, and marked asthenia, together with a clear mentality and a positive blood culture, the diagnosis of lateral sinus thrombosis is complete.

A profuse aural discharge may greatly diminish in quantity or in some cases cease. The pain may be slight in some cases, and excruciating in others, and may radiate over any part of the head or neck, not necessarily being referred to the immediate site of the lesion for its greatest intensity.

Positive blood cultures are accepted by some authors as being wholly characteristic of sinus thrombosis. However, sepsis does occur in the absence of these findings, for some unexplained reason. Furthermore, a sterile clot may completely occlude the vessel, in which case it could not give rise to a bacteremia; hence we get a negative blood culture.

Following mastoidectomy, chills and a high intermittent fever should be regarded with suspicion, and inasmuch as ocular changes are present in a large percentage of cases, even though they may be slight, ophthalmological examinations should be made frequently and are of definite value. When the cavernous sinus becomes involved, with extension to the ophthalmic vein, exophthalmos and edema of the eyelids are present. Dilatation of the superficial veins of the temples, forehead and eyelids follows pressure on a normal jugular, whereas no such effect is produced by pressure over an obstructed jugular.

One of the most characteristic and important symptoms is temperature of the so-called "pumphandle" variety. When this occurs, especially if accompanied by chills, during the course of an acute middle-ear disease, or should it suddenly occur during the after-treatment, following a mastoid operation, sinus involvement should at least be suspected.

Sinus thrombosis is quite uncommon in both the aged and the young, the greatest incidence being between the ages of seven and forty. This should help us to be as conservative as possible, taking into due consideration the gravity of the situation.

The general bacteremia following the entrance of bacteria into the blood stream is responsible for the severe general symptoms. It is under such conditions that infractions occur, causing metastases in other parts of the economy, and even if an operation is performed at this time to remove the original focus of infection, it may be too late to save the patient. Our chief object, therefore, is to recognize the disease before such grave complications occur.

Phlebothrombosis of Intracranial Sinuses. While thrombosis of the cranial sinuses is usually caused by middle ear suppuration, C. C. Charlton[4] mentions as possible causes, dental caries, anthrax, erysipelas, orbital cellulitis and retropharyngeal abscess.

In infective thrombosis there is always a phlebitic condition which, on account of the inflamed vessel wall, causes the blood to adhere and clot. This clot generally disintegrates rapidly as germ-laden pus formed by the vessel wall mingles with it and forms greenish brown

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(4) Ann. Otol., Rhinol., and Laryngol., June, 1923.

fluid which is filled with living organisms and is likely to be carried into the circulation with widespread metastases.

The clot in sinus thrombosis begins by a fibrin deposit at the point of invasion of the infection and may gradually enlarge to obstruct the vessel and extend from the lower end of the jugular vein to all its tributaries, facial, thyroid, condylar, mastoid, emissary superior and inferior petrosals, and through the lateral to the sinuses of the opposite side. These thrombi may be mural or complete. When complete, the extremities may be sterile through the action of the antiseptic circulating blood and yet the center, if infected, remains so. When the infected portion breaks through into the blood stream, septic emboli are carried to the lungs, joints and superficial tissues in the order named.

Of all the sinuses the one that lies nearest to the cellular structure of the ear is the sigmoid portion of the lateral sinus. On the left it carries most of the blood from the interior of the brain, while on the right side it drains the surface blood from the veins. It varies in distance from the suprameatal spine, from close proximity to about one inch, and is the one most frequently involved.

Sigmoid invasion generally arises from a middle ear involvement. If in a chronic otitis media there is a sudden cessation of discharge with persistent pain extending into the head, high temperature with steeple-like fluctuation, vomiting and rigors, it may be regarded as pointing to thrombosis of the sigmoid sinus. Other symptoms that may be looked for are venous obstruction of the sinus, which causes overdistension of the external jugular and other superficial veins, and those caused by mastoid inflammation, tenderness and edema back in the posterior cervical triangle from the emissary vein as it emerges at the occipitotemporal suture. There may be enlarged cervical glands, especially along the internal jugular and soft tissue, cervical abscesses arising from venous thrombosis, systemic affection, pulmonary involvement, an infected enteritis and metastatic invasion of the joints or other tissues, even in the remote parts of the body.

The consensus of opinion among otologists is in favor of ligation of internal jugular vein for lateral sinus thrombosis. It might be stated that, according to published records of many of the cases where the ligation was performed, no clot was found, but many recoveries took place because they were cases of phlebitis with bacteremia and by ligating infection was cut off from the blood stream.

When the sinus has been exposed, it should be packed with iodoform gauze plugs so that the pressure will be between the bony structure and soft tissue wall, completely compressing the vessel. After this the sinus should be opened between the plugs and the connected contents evacuated. After thorough evacuation of the sinus, one plug is removed, and if spontaneous bleeding takes place it should be replugged; then the same thing should be done to the other end. If free bleeding does not take place, search should be extended for the cause and currettement continued until bleeding is established. These plugs should not be removed before eight or ten days; if there is no bleeding replugging is unnecessary. A large portion of sinus wall should be removed.

Diagnosis and Treatment of Septic Thrombosis. Septic invasion of the lateral sinus is a comparatively rare complication of purulent otitis media according to W. C. Phillips,[5] but when it does occur it is generally conceded that lateral sinus infection is induced either (a) by extension of the infective process within the

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(5) Jour. Amer. Med. Ass'n., Aug. 25, 1923.

temporal bone through the smaller veins whereby the latter become involved with septic thrombi, which gradually extend to, and infect, the sinus; or (b) because the infection in the bone extends, by contiguity, directly through its internal table to the walls of the blood vessel, where its farther advance is characterized by infection of the sinus walls, and thence into the blood stream with resultant thrombosis. Furthermore, according to Boenninghaus, thrombosis may occur from infection located within the labyrinth, in which event the sinus involvement is usually located below the level of the knee or through involvement of the inferior or superior petrosal sinuses.

In another group of cases, the infection proceeds from a labyrinthine infection directly toward the bulb, through involvement of the lymph spaces of the middle ear, or through the extension of a thrombosis of the jugular bulb may take place from direct infection through dehiscences in the floor of the tympanic cavity. We must conclude, therefore, that plebitis and thrombosis of any part of the lateral sinus and internal jugular vein may result from (1) anatomic dehiscences in the bony tissue of the parietal wall; (2) direct extension in its walls of the active purulent lesion in the bone; (3) involvement of the smaller veins of the diseased bone, or (4) involvement of the intermediate anastomotic veins in the thrombotic area.

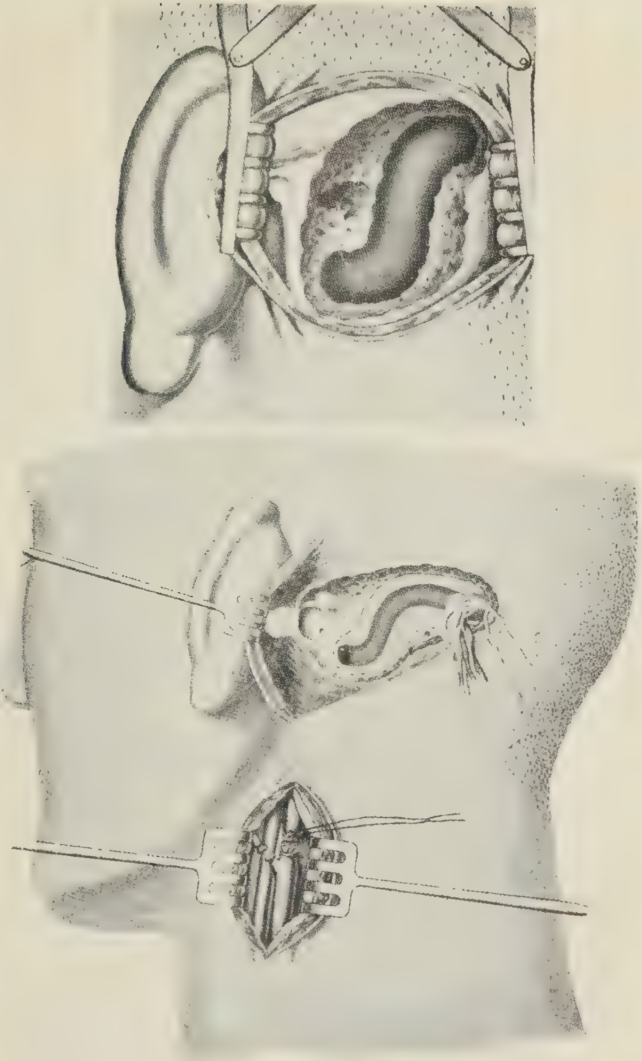
In the management of cases of lateral sinus infection, the diagnostic pathway of the otologist is often beset with serious difficulties and trying experiences. These difficulties arise from the fact that in a considerable proportion of all cases the symptoms of the invasions do not follow a typical course. In typical cases in which only one ear is involved, when accompanied by the usual variation in temperature and the early appearance of bacteremia, a diagnosis is easily determined. In this type, the symptoms are so characteristic that but little along the line of differentiation becomes necessary. Erysipelas, particularly when the surface manifestations are delayed, often produces similar temperature variations to those seen in early stages of typical cases of septic sinus thrombosis.

A high temperature continuing several days after a mastoid operation, especially when the operative findings have disclosed areas of necrosis of the bony covering of the lateral sinus, and examination of the blood shows bacteremia, leukocytosis and a high polymorphonuclear percentage, and no other body complications. furnishes sufficient evidence to call for an examination of the interior of the sinus.

Of the previously mentioned symptoms, the presence of bacteremia, not otherwise accounted for, is the most convincing diagnostic symptom. In both types of sinus involvement, particularly when occurring in chronic purulent otitis media cases, the patient has a chill with each rise of temperature, but this symptom is often absent in young children and it is in young children with acute cases that we meet our most trying difficulties. It is surprising how many writers on this subject fail to mention or to take advantage of so important a measure as blood cultures for bacteremia.

Regarding the type of operation to be performed on the vein of the neck, opinions still vary. The majority of operators have gradually come to believe that simple ligation of the vein accomplishes every purpose, and it does not seem to matter even if the vein is ligated in its lower portion. Theoretically, it would seem wise to ligate above the entrance of the facial vein, but practically the lower ligation is fully as effective and is much more easily accomplished. A complete dissection of the vein is still advocated by some operators on the ground that it removes a larger infected area, but

PLATE XXIX.



Surgery in septic otitic thrombosis of cranial blood sinuses of jugular bulb.—Fraser, page 305.

statistics prove that ligation is equally effective and successful. The fact that ligation, particularly when made in the lower portion of the vein, can be accomplished quickly and without subjecting the already weakened and exhausted patient to prolonged anesthesia, counts much in its favor, and Nature seems to care for all the rest, except in occasional cases in which the prolonged temperature is finally relieved by opening up the bulb region freely from the mastoid wound.

Septic Otitic Thrombosis of Cranial Blood Sinuses of Jugular Bulb. In dealing with the jugular vein in sinus thrombosis, it is the routine practice of J. S. Fraser[6] to divide the common facial vein between ligatures, near its junction with the internal jugular. The jugular vein itself is then divided between ligatures just below the point. The ligature is left "long" on the upper or bulb end of the internal jugular vein. A day or two later the upper end is opened or the ligature removed, and, in many cases, sterile saline fluid is syringed through the bulb from the lower part of the sigmoid sinus, the fluid emerging through the upper end of the internal jugular into the neck wound, which is of course left open. Unless the upper end of the vein is opened it is apt to become transformed into a bag of pus. It is questionable, however, whether much good is done by syringing through the bulb, because the vein itself makes an ideal drainage tube for any septic matter which may be present in the jugular bulb. The sinus in the neighborhood of the mastoid is thoroughly exuterated. (Plate XXIX.)

Thrombosis of Cavernous Sinus. In a symposium on thrombosis of the sinuses, G. E. De Schweinitz[7] reports five fatal cases of thrombosis of the cavernous sinus, two of which were sequelae of otitis media, two from unascertained causes, and one from a boil on the nose.

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(6) Edinburgh Med. Jour., Apr. 2, 1924.
(7) Atlantic Med. Jour., June, 1924.

OTHER COMPLICATIONS OF AURAL INFECTION

Acute Meningitis. A case of acute meningitis is reported by M. Renaud[8] in a young woman who had suffered with infantile spastic paralysis since 5 years of age. The brain lesion was caused by a suppurative process in the petrous portion of the temporal bone which Renaud thinks had existed since childhood and was probably the cause of the paralysis.

Sixth Nerve Paralysis Associated with Mastoid Disease. A case of sixth nerve paralysis associated with mastoid disease is reported by Edward King.[9] A diagrammatic photograph shows the relations of the sixth nerve. There is a small spine-like process on the upper surface of the petrous portion of the temporal bone which points toward the post-clinoid process. A small ligament composed of the deepest layers of the tentorium extends across the space between these two processes forming a bridge to complete a canal called Dorello's canal. Through this canal the sixth nerve passes and at this point it is closely related to the petrous bone. It is at this point that the inferior petrosal sinus joins the post end of the cavernous sinus, and so it is evident that any swelling of the walls of the canal will produce pressure on the nerve. The swelling may arise from inflammatory changes in the bone and the sixth nerve passes immediately to the inner and upper edge of it.

Gradenigo's explanation of the involvement of the sixth nerve lies in the extensive pneumatization of the temporal bone. In large pneumatic cell mastoids the cells ramify in all directions so that they are found at

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(8) Bull. de la Soc. Med. des Hopitaux, May 30, 1924.
(9) Cincinnati Jour. Med., July, 1924.

the tip of the petrous bone. Pus retained under pressure makes its way along the course of these cells. He reports the post-mortem findings in five cases which terminated in meningitis. A localized abscess was found at the apex of the petrous bone in three cases and in the other two a carious process was discovered in the same area.

A study of the cases reported shows that the majority of them recover. The nerve involvement appeared in about one-third of the cases following operation, but this in itself is not an indication for the operation. The function of the nerve returns in most cases rather promptly, in others the restoration is prolonged over months.

Gradenigo's Symptom Complex. Gradenigo's symptom complex, first published in 1904, is described by W. R. Chamberlin,[1] who reports four additional cases. This syndrome or symptom complex is in brief as follows: (1) a purulent otitis media, with or without mastoid involvement; (2) severe pain referred to the temporal end parietal regions on the affected side and explained by Gradenigo as being due to an involvement of the gasserian ganglion; (3) paralysis or paresis of the sixth or abducens nerve on the same side.

Gradenigo divides the cases into three groups: (1) those in which there is present the typical syndrome and no other complication; (2) the typical syndrome, and in addition secondary symptoms, such as the second, third or fourth nerve paralyses; (3) a group, evidently of virulent type, first presenting the classical syndrome but later developing meningitis, with death ensuing.

The consideration of the clinical picture, he says, leads him to believe that the progress is along the preexisting anatomical paths. These paths are described by Perkins as follows, though he considers that there may also be others.

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(1) Atlantic Med. Jour., June, 1924.

1. The infection may follow the sublabyrinthine route, extending from the tympanum below the labyrinth and internal auditory meatus to the petrous tip.

2. From the mastoid antrum it may extend through the subarcuate fossa or petromastoid canal, which passes inward beneath the superior semicircular canal, and reach a layer of cells sometimes lying above the internal auditory meatus, and thus arrive at the petrous tip.

3. Or this point may be arrived at by way of the carotid canal, access to which is obtained either by eroding the bone on the anterior tympanic wall, or through one of the caroticotympanic foramina which give passage to the carotid branches of the tympanic plexus.

4. Finally the infection has been found in some autopsies to be through a layer of cells extending along the eustachian tube, thus passing from the tympanum to the petrous tip.

The vulnerability of the sixth nerve is due to its exposed course, the basilar portion being approximately one inch in length.

The pain is due to the proximity to, and consequent involvement of, the gasserian ganglion, the latter lying in a depression on the anterior surface of the apex of the petrous portion of the temporal bone.

Conclusions. 1. The Gradenigo symptom complex is of sufficiently frequent occurrence to deserve the attention of every otologist.

2. The ophthalmologist should be continuously on his guard to see that external rectus paralysis of otitic origin is not mistaken for the more frequent forms of abducens paralysis, with which he is more familiar.

3. A sixth nerve paralysis, associated with pain over the side of the head and a discharging ear, should have an early, if not an immediate, mastoid operation.

4. Although mastoid operation, with the free drainage which it affords, does not insure relief, it is the best means which we have and certainly lessens the dangers of intracranial involvement.

A Consideration of Otitic Brain Abscess, with Special Reference to Diagnosis and Localization. According to S. MacCuen Smith[2] two barriers stand in the way of success in the handling of brain abscess cases: the first is the serious state of patients applying for treatment, and the second is our faulty and inaccurate methods of localization. The former, the advanced illness of the patient when first seen, continues to be the chief obstacle to a lessened mortality, because the early symptoms and indications are not recognized as primary to an intracranial lesion. Considerable advance has been achieved in the second difficulty—localization—with indications of a progressive betterment.

The vital point that we are called upon to determine is the presence of a cerebral suppuration in its early stages, even though it may be too early to make serious effort at localization. This is quite possible, even in slowly developing cases and before the evidence of compression becomes manifest.

In the initial stage we have headache, fever, chills, or chilly sensations, and periodic vomiting. The symptoms may rapidly subside, which supports an incorrect diagnosis of acute indigestion or abdominal grippe.

The latent stage may continue indefinitely, but the patient does not enjoy good health. He has periodic headache, avoids exertion, shows changes in physical and mental habits, and becomes increasingly morose and eccentric, until finally, complicating some supposed general illness, he suddenly shows marked symptoms of an intracranial lesion, and is ushered into the stage of manifest symptoms, chiefly general debility,

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(2) Laryngoscope, July, 1924.

weariness, loss of appetite and flesh, constipation, and a general feeling of malaise, and sometimes convulsions in children.

Headache is one of the most common and important symptoms, this notwithstanding the fact that the patient may have been subject to head pains. The pain may range from a dull headache to the most acute suffering and may involve any part of the head, from the temporal region to the occiput, depending on the location of the abscess, or it may be general and have no reference to localization. If localized, it is not necessarily confined to the side of the aural infection. In only one or two instances has the author been able to elicit pain on percussion, as has been suggested by some authors. In one case the headache had continued intermittently for a period of several months before the chilly sensations developed, the mother believing that this headache was peculiar to the child and had nothing to do with her progressive illness, as she (the mother) had always suffered from what was termed "a woman's headache." At operation this cause proved to be an encapsulated abscess.

Although subnormal temperature is distinctly characteristic of a brain abscess formation, it must be remembered that this occurs only when the process does not involve the dura. It is not uncommon to have more or less of a rise in temperature when the suppurative process works its way toward the surface and produces a localized involvement of the meninges. Later, as the process becomes walled off, the temperature will again become about normal.

Convulsions, especially when associated with other indicative symptoms, are almost pathognomonic of intracranial abscess formation, especially in children suffering from a chronic otorrhea. In the author's experience, convulsions are common in children, but very infrequent in adults. Disturbances of the sensory and mental state are always present. At first the patient is apathetic and drowsy, yawns, answers questions slowly and with hesitancy. Periods of alertness and clearness of mind alternating with an apparently unconscious state, are followed by a failing memory, then mental dullness, ending in stupor and coma; the former may continue for some time and this is the opportune moment for operation, before the later—and terminal—stage intervenes.

High temperature, pulse and respiration are characteristic of the acute invasive stage. In one of the recent cases, these symptoms, together with severe headache, led the attending physician to suspect a meningitis, in the presence of a discharging ear. In the course of two or three days all symptoms except the head pain subsided, leading to the belief that the illness was due to gastro-intestinal disturbances. Very shortly, however, symptoms of compression, including aphasia, led to a realization that an intracranial lesion existed, which proved to be a temporal-lobe abscess.

In the absence of localizing symptoms, slow pulse and respiration and low temperature, together with a persistent headache, would lead us to suspect involvement of the right temporosphenoidal lobe.

Recurrent attacks of stupor offer a valuable diagnostic point in the early stages of temporosphenoidal abscess. These become more pronounced and finally continuous as the expanding lesion of that lobe progresses.

The development of hallucinations of various types in the presence of an intradural lesion, of which much has been written, indicates involvement of the temporosphenoidal lobe. As compression increases the mentality markedly changes, slowness of speech and comprehension are replaced by heedlessness or mental aberration. Periods of somnolence may suddenly change to a state of mental excitation simulating delirium.

Cerebellar abscess is much more difficult to diagnose, especially in the early stages, than is an abscess of the temporal lobe. Early manifestations are frequently observable in temporosphenoidal abscess, but symptoms that are more or less characteristic of cerebellar abscess commonly do not occur until pressure symptoms show themselves, such as vertigo, paralysis of the face and extremities of the same side, projectile vomiting, staggering gait, spontaneous pointing deviation, spontaneous vertical nystagmus, falling, and lateral deviation of the eyes.

If symptoms of intradural suppuration are present and tests reveal a dead labyrinth or the presence of a lateral sinus thrombosis, the indications are in favor of the abscess being located in the cerebellum. The patient is inclined to fall towards the opposite side from the lesion, and this, with optic neuritis, will serve to differentiate this condition from internal ear suppuration, in which the gait is of a swaying or staggering character, without optic neuritis.

We must recognize that the stimuli for muscular co-ordination and tonicity originate in and are controlled by the functional activity or inactivity of the cerebellum. Therefore any deviation from the normal, such as muscular paralysis (which, however, would not be complete unless the pyramidal tract was involved), would indicate cerebellar involvement.

Summary. The use of the vestibular tests in the diagnosis of brain abscess may be summed up as follows. They are useful in that frequently they are the only tests that indicate with any degree of definiteness the presence of intracranial involvement. There is nothing about them that would directly suggest an abscess, but what they do indicate is the presence of increased intracranial pressure.

Given a case of unoperated aural suppuration or one where the operation has been performed and the patient is not doing just right, the findings of a spontaneous vertical nystagmus or of a loss of responses from the vertical semi-circular canals, without such a loss from the horizontal canal, or of a perverted nystagmus after douching, etc., at once leads us to suspect very strongly the presence of some intracranial lesion. When the general clinical picture and laboratory tests exclude everything except brain abscess, the vestibular examination might indicate whether such an abscess is in the cerebellum or temporal lobe. The ability to elicit vertigo and past-pointing after stimulation will eliminate the cerebellum and suggest the temporosphenoidal lobe as the probable site of the trouble.

Inasmuch as intradural suppuration does occur without indicative manifestations, it is a wise precaution to determine the labyrinthine reactions prior to all mastoid operations for the relief of a chronic otorrhea, as sometimes the Barany tests give the only clue to an intracranial lesion.

THE INTERNAL EAR.

The Results of Functional Tests in 44 Children with Congenital Deafness. In a group of 27 cases of congenital deafness reported by A. M. Alden[3], there were 15 girls and 12 boys. Eight of these pupils had no demonstrable hearing and 19 had residual hearing varying from slight sound perception to recognition of change of pitch of an interval of less than an octave. In the group of eight cases which had no hearing two had an entire absence of vestibular function, in four it was present but diminished and in two the vestibular apparatus reacted normally. In the group of 19 cases which had residual hearing ten gave normal vestibular reactions, in seven the reactions were present though

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(3) Laryngoscope, September, 1923.

diminished and in one case with a fair amount of hearing there was an entire absence of vestibular response. From this data it will be seen that the fact that either the vestibular or the auditory end of the eighth nerve reacts, even normally, does not necessarily mean that there must be some function in the other side. While in 16 cases the absence or presence of function was coincident in each portion of the nerve, in two cases we have normal vestibular reaction with no hearing and in one case considerable residual hearing with no vestibular reaction whatsoever.

A question seems natural at this time. How does it happen that in the 27 cases of congenital damage to the acoustic mechanism ten cases still retain normal vestibular function and in the ten cases in which the vestibular reactions were reduced the reduction was nowhere as great as the relative reduction of acoustic function? In other words, why is the vestibular portion of the nerve apparently more resistant to congenital malformation than the acoustic portion? This may be explained on the basis of reversional variation. Developmentally the vestibular mechanism is very old, extending down the phylogenetic series below the fishes while the cochlea is a relatively recent addition. Accepting the fact that where congenital deviation from the normal occurs it is always to a more primitive type, and that the more recently acquired characteristics are those most vulnerable to change, then when a reversional variation occurs which affects the eighth nerve naturally the auditory portion is more often the seat of the change than the pars vestibularis.

In a group of eleven cases of acquired deafness seven are girls and four are boys. Five of these were due to meningitis, five to scarlet fever and one to diphtheria. In each of the meningitis cases there is an entire loss of vestibular and acoustic function, no reactions whatsoever being obtainable by any sort of stimulation.

In the five cases following scarlet fever the vestibular reactions are diminished in four and absent in one, while all show varying amounts of residual hearing. Deafness in three of these cases followed suppurative processes in the ears and in two the deafness was apparently due to labyrinthitis of either toxic or haemorrhagic origin. In these cases the vestibular and auditory portions of the nerve have both suffered damage which is usual in disease processes of this nature which involve the inner ear.

The case in which deafness was the result of diphtheria at the age of eighteen months gives normal vestibular reactions and a considerable amount of residual hearing. This is difficult to explain on the basis of pathology. While it is theoretically conceivable that a toxic process might affect the acoustic nerves alone and the vestibular endings remain untouched, a more plausible explanation is that this was a case of congenital deafness which became manifest at that time.

The remaining six cases in this group are classed as doubtful because of lack of definite history as to the cause of the disease. Three of these show normal vestibular findings and in three vestibular responses are present but diminishd. All but one have demonstrable hearing. Probably most of these were of congenital origin.

Labyrinth Deafness. In a discussion of labryrinthine deafness D. McKenize[4] states that although we cannot cure a destructive cochlear lesion we can at least prevent its occurrence in a large and important group of cases. There is reason to believe, as we have seen, that most cases of labyrinth deafness are due to middle-ear disease, and many advancing diseases of the middle ear can be, if not cured, at least brought to a standstill. Thus it is in prevention that our most powerful remedy is to be found. Fleeting attacks of middle-ear catarrh

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(4) British Med. Jour., Nov. 10, 1923

in children and young adults, occasional bouts of earache, little turns of deafness from a "cold," should receive the strict attention they deserve. And a heavy responsibility rests upon those who venture to decry such a simple operation, for example, as the timely removal of adenoids in the young. For there is a good reason to believe that those trifling and evanescent attacks foreshadow serious middle-ear deafness in early manhood, and later the grave and irreparable involvement of the labyrinth.

Labyrinthitis. Nonsuppurative labyrinthitis according to Wm. Milligan[5] is a toxic neuritis affecting at first the nerve proper, but later extending to the maculae acousticae, where it sets up a vicious circle of static incoordination, oculo-motor, and gastric disturbance.

Present Position of Surgery of Labyrinth. In purulent labyrinthitis the infection may, according to W. Milligan,[6] extend to the labyrinth from the base of the brain along the perivascular sheaths of the auditory or facial nerves, and in exceptional cases, from erosion of the eminentia arcuata, the result of an extradural or subdural abscess in the middle fossa. More frequently, however, septic infection spreads through one or another portion of the capsule of the labyrinth as the result of the presence of chronic middle-ear purulency. Septic labyrinthitis is rare as the result of acute purulent otitis media, the lesion under such circumstances being more frequently an acute serous labyrinthitis.

The portals of invasion are the lateral or external canal, the stapedio-vestibular articulation, the fenestra rotunda and the pars promontoria. At times, however, the labyrinthine capsule is so riddled with disease, more especially in tuberculous cases, that the actual portal of entry is impossible to determine.

When infection takes place through the bony capsule of the canalicular system, the symptoms will be mainly

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(5) Lancet, Feb. 9, 1924.
(6) Practitioner, May, 1924.

static, when through the cochlear wall mainly dynamic. In course of time generalized infection of the whole of the labyrinth will take place, but it is important to note that one or other segment may remain involved for a considerable period without any implication of the other.

In the course of many "complete" mastoid operations an erosion of the bony wall of the lateral canal is by no means infrequently, and often quite accidentally, found, there having been no previous clinical evidence of labyrinthine involvement. Under such circumstances, the erosion should, after disinfection, be left severely alone, reliance being placed upon the free drainage obtained as the result of the post-aural operation. To interfere with what is simply an erosion, to run the risk of converting it into a fistula, with the possible setting up of a circumscribed or diffuse labyrinthitis, is the height of folly. Such erosions are the outcome of insufficient and inefficient drainage of the middle-ear cavity, or the result of pressure absorption from a cholesteatoma.

When infection reaches the interior of the labyrinth, it may result in the production of:

1. A circumscribed labyrinthitis;
2. A diffuse purulent labyrinthitis;
3. An acute serous labyrinthitis.

In circumscribed labyrinthitis, the pathological process is limited to the neighborhood of the portal of entry. Clinically, its existence is indicated by attacks of static incoordination, nausea, and possibly sickness. There usually is a certain degree of deafness, and tinnitus may or may not be complained of. The fistula symptom is positive, there is rapid response to the caloric test, and nystagmus, usually horizontal, is well marked. Should the infective process become diffuse and manifest, there is a decided increase in the severity of all symptoms. Sickness and incoordination become pronounced, there is definite rotatory nystagmus to the healthy side, and complete, or almost complete, deafness. The functional activity of the labyrinth is so abolished that the caloric, the turning, and the fistula tests become negative.

In circumscribed labyrinthitis the present consensus of opinion is in the first place to trust to the removal of the septic focus causing it, and to rely on the free drainage afforded by the performance of a radical mastoid operation. In the event of symptoms either not subsiding or actually increasing, the infected canal or canals should be opened, freely disinfected and drained, care being taken not to interfere with the cochlear segment, for under such circumstances a very considerable and useful amount of hearing may be retained.

In diffuse purulent labyrinthitis the indication is to secure efficient drainage, even at the expense of exenterating the whole internal ear. Every care should, however, be taken to endeavor to preserve as much of the cochlea as possible, practical experience proving that a considerable degree of functional activity of the auditory nerve may be retained if and when efficient posterior drainage has been effected.

Vertigo and the Otologist. Toxemias affecting the labyrinth, according to L. Levy[7], include ptomaine poisoning, alcoholism, lead, quinine, salicylates of soda, nephritis, gout, rheumatism, syphilis, infectious fevers, such as mumps, scarlatina, and typhoid fever. These toxemias are grouped into two classes.

1. Evanescent toxemias which have produced no degeneration of the cellular elements within the internal ear or its intracranial pathways. The cases of evanescent toxaemia constitute a very large proportion of the cases of vertigo seen by the physician and are best illustrated by the dizziness produced by overdoses of alcohol.

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(7) Jour. Tennessee State Med. Ass'n., February, 1924.

2. Toxemias which produce a definite impairment of some portion of the ear or its pathways. In the toxemias producing marked impairment we have examples in mumps and syphilis.

Since it is true that vertigo from whatever cause can result only from an affection directly upon the vestibular apparatus, it is only natural for the physicians to request the aid of an otologist in diagnosing such cases, and in order better to understand the tests one must briefly review his anatomy of the internal ear and pathways. The internal ear is divided into the cochlea, the organ of hearing, and the vestibular or static part for equilibration. It is this part of the internal ear which when disturbed causes vertigo. The static portion consists of three semicircular canals which appreciate the turning movements of the body, the utricle presiding over the linear movements in the anterior-posterior direction, and the saccule, side to side movements. From these, this portion of the eighth nerve enters the brain stem at the junction of the medulla oblongata and the pons, impulses passing through the cerebellum and cerebrum to the second convolution of the temporal lobe, known as the vertigo center, and it is possible by one's knowledge of the course that these tracts pursue within the brain substance often to locate accurately the site of lesion responsible for the vertigo.

Vertigo from disease is different and results whenever there is an interference with the perfect balance between the special static organs on each side. If vertigo can be produced only by diseases affecting the vestibular apparatus we must necessarily employ those tests that differentiate the function of this apparatus. Examination of this kind comprises a search for any spontaneous vestibular phenomenon that may be present, as well as an analysis of the responses to ear stimulation. The latter method, of course, is the most important.

Through experimental or induced vertigo, produced by the turning chair or by means of douching the integrity of the pathways responsible for it, vertigo has been studied. In making our tests we start out with a fixed and definite idea that a normal nerve center produces a rhythmic nystagmus and vertigo when a stimulant is applied. When an individual is turned in a chair ten times in a given direction the nystagmus lasts about twenty-six seconds in a certain direction. The vertigo is also about twenty-six seconds' duration, because in vertigo there is pastpointing and falling. If stimulation fails to produce one or all of the responses there is impairment at some point of the apparatus.

In our tests the static portion of the internal ear is the starting point for all nystagmic and vertigo impulses. If in testing the internal ear we fail to produce a response we conclude the lesion is either in the labyrinth or the eighth nerve. On the other hand, if stimulation produces one good reaction at the same time others are absent we know the end organ is intact and suspect a central lesion, that is, after the eighth nerve has divided into its component portions on entering the brain stem at the junction of the medulla oblongata and the pons. If nystagmus is poor or missing we think immediately of a block in the vestibulocular tracts, while on the other hand if it is vertigo that is subnormal or absent after stimulating and demonstrated by pastpointing or falling, we look for a block along the vestibulo-cerebello-cerebral tracts which produce vertigo. It is true one may have vertigo without pastpointing or falling, yet on the other hand without vertigo there will be no pastpointing or falling. In our tests we often find patients who, although complaining of vertigo, show normal reactions to ear stimulation when tested. This simply means the vestibular apparatus is irritated at some point and a search should be made for the source of irritation. It is this type that is usually due to focal infection from the teeth, tonsils, stomach, etc., and presenting symptoms of a sudden onset with nausea, or vomiting or both, a sensation as though surrounding objects were whirling in a definite plane and marked accentuation of the vertigo in certain positions or with certain movements of the head. Although the duration of these attacks is brief, the recurrence finally brings the patient to the physician. It is in this type of case, when tested, that we find in the early stages a normal labyrinth, but with repeated attacks we then have a chronic labyrinthitis.

Vertigo and its Significance in General Medicine. In a discussion of vertigo and its significance in general medicine, R. S. Pentecost[8] gives four causes for vertigo of central origin.

1. Cerebral congestion or cerebral anemia. Cerebral congestion may be present in many cases of acute infectious disease, and cerebral anemia is particularly noticed in cases of arterio-sclerosis, endarteritis, pernicious anemia, and other conditions affecting the cardio-vascular system.

2. Toxemia, either acute or chronic. Among the acute toxemias one might mention alcohol, tobacco, and the toxins generated during acute infections. Chronic may include auto-intoxication of intestinal origin, and particularly focal infections in the tonsils, teeth, and other areas. Cases of vertigo due to evanescent toxemia probably constitute a large proportion of the cases of mild vertigo seen by the physician.

3. Focal lesions in the brain of vascular origin, including perivascular and paravascular sclerosis, miliary hemorrhages, and complete or incomplete areas of miliary softening, are a frequent etiological factor. In 69 cases of multiple sclerosis recently reported by Fischer, vertigo was present in 51 per cent. The writer has examined several cases of disseminated sclerosis

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(8) Can. Med. Ass'n. Jour., October, 1923.

in which vertigo was present, and in all there were objective signs of definite interference with the tracts of the vestibular fibres.

4. Brain tumor. "Dizziness is rarely absent in growths below the tentorium, and is one of the earliest symptoms of brain tumors in any area. The curious tilted attitude of the head seen in some cerebellar cases, is probably of vestibular rather than cerebellar origin." (Foster Kennedy.) In a series of ten cases of tumors of the cerebello-pontine angle reported by Vail, from the Cushing Clinic, the examination by means of the Barany diagnostic tests showed constant and definite findings in every case.

Summary. 1. Vertigo is the result of interference with the function of either the vestibular, ocular, or kinesthetic senses. It varies in character from a slight sensation of swimming of the head to a sensation of a definite rotation of the body and of external objects. In some cases, the resulting nausea or vomiting, or equilibrial disturbances, may be the chief complaint of the patient.

2. The etiological factors are numerous, and, in the differential diagnosis, it is essential that one should obtain a detailed statement from the patient as to the character of the vertigo, whether influenced by change in position of the body, quick movements of the head, or closure of the eyes.

3. The examination of the patient should include a general physical examination, and, in cases of severe or persistent vertigo, a complete examination of the ear and vestibular apparatus according to the systematized diagnostic methods of Barany and Jones.

Labyrinthinitis. Symptoms of labyrinthine fistula are described by S. Watson-Williams[9] as follows. When the air pressure in the meatus is raised there is instant deviation of the eyes to one side (commonly the sound

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(9) Bristol Med.-Chir. Jour., July, 1924.

side) and nystagmus to the other side; when the pressure is reduced there is instant reversal of the phenomenon. The nystagmus stops abruptly on releasing the pressure or suction. The sign is not very common; to elicit it only gentle pressure is required; instant response, and instant reversal, are essential points. More marked pressure will in a large number of cases with otorrhea give a similar sign after a latent period of two to five seconds. This is the psuedo-fistula sign, and its usual direction is the reverse of that most common with the true fistula sign. It does not indicate labyrinthine disease. The author has met with this phenomenon as a symptom. The patient, a builder, was the subject of right chronic suppurative otitis media, without any labyrinthine lesion; the fistula test was negative on many trials. Recounting his symptoms, this man said: "If I put the wool into my ear too hard everything goes round to the left; but if I pull it out too sharp everything goes round to the right." Needless to say, either form of response is indicative of a living labyrinth, and may sometimes even be obtained when the labyrinth does not respond to the caloric test.

Otogenic labyrinthitis may be acute or chronic; it may further involve the whole labyrinth, or a part only. In the latter case—circumscribed labyrinthitis—the labyrinth will respond to some of the tests of function; in the former—pan-labyrinthitis—there will be no response, except perhaps during the first five or six hours. The distinction has been made between acute serous and acute suppurative pan-labyrinthitis; the diagnosis rests on whether there is or is not eventually some restoration of function, and clinically can hardly be made in the acute stage. Further, acute labyrinthitis may supervene on acute or on chronic middle-ear disease, or on chronic circumscribed labyrinthitis; chronic labyrinthitis may follow an acute attack, or may be chronic *ab initio*; indeed, cases have been described where the entire labyrinth is destroyed, but so insidiously that labyrinthine symptoms are related to the rapidity of destruction of function, rather than simply the extent of such destruction.

The correct diagnosis of any given case has an important bearing on the treatment. When should one operate on the labyrinth? One class of case imperatively demands such an operation. When acute panlabyrinthitis supervenes on a chronic otitis media, or on chronic circumscribed labyrinthitis, the labyrinth soon ceases to respond to tests. It is, of course, possible that the damage will be arrested naturally. Unfortunately, if it is not, since the labyrinth gives no indication of what is occurring, the next signs of progress of the disease are those of suppurative meningitis. Some authorities even consider the majority of all cases of septic meningitis as due to labyrinthine infection. It is true that even where meningitis is present the situation is not quite hopeless; but the chances of recovery have been gravely jeopardized. If, therefore, such a case is seen early, the labyrinth should be drained.

The Nose and Throat

GEORGE E. SHAMBAUGH, M. D.

THE NOSE AND THROAT.

GENERAL CONSIDERATIONS

Further Studies of Fatalities Following Operations on the Nose and Throat. Four hundred and forty-four fatalities following operations upon the nose and throat are reported by H. W. Loeb.[1] Three hundred and thirty-two cases were presented one year ago, and to these the author has added 112 more, making a total of 444 cases. The series is grouped as follows: Meningitis, 168; hemorrhage, 76; general sepsis, 27; erysipelas, 9; endocranium (excluding meningitis), 31; heart, 5; respiratory tract, 55; miscellaneous, 36; undetermined, 37. The records of many of the cases show disregard of indication and contraindications, inexpertness, patients exposed to the risks of multiple operations, postoperative inattention, and unforeseen accidents.

The following examples are cited. Incision of a supposed peritonsillar abscess followed by death from acute lymphatic leukemia; death from myelogenous leukemia after tonsillectomy; acute nephritis following combined submucous resection and tonsillectomy in a patient suffering from nephrolithiasis; meningitis following resection of a middle turbinate (the patient, who left town

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(1) Ann. Otol., Rhinol., and Laryngol., December, 1923.

on the same day, having a hemorrhage that night, had his nose plugged by an inexpert physician); extensive removal of polypi followed by meningitis, autopsy showing that a portion of the cribriform plate had been torn away; and cavernous sinus thrombosis following complete exenteration of both ethmoid labyrinths and resection of the anterior walls of both sphenoids.

The author also mentions tonsillectomy on a patient who was intoxicated one day before and four days after the operation, death occurring from meningitis; pansinus operation three days after an acute cold, followed by death from meningitis; death in three days following removal of polypi with biting forceps, resection of ethmoid cells and middle turbinates on both sides; tonsillectomy in a patient who had two attacks of Vincent's angina, death resulting from pulmonary abscess; tonsillectomy followed by death in twelve hours from hemorrhage in a hemophiliac; and injury to the meninges in removing polypi, the brain substance coming through the nose while the patient was lying down in bed—confirmed by autopsy.

The author urges all who meet with these unfortunate experiences to insist upon autopsies and complete autopsy records, to ensure a better understanding of the processes involved and the means of combating them.

[This important work by Loeb is very timely and serves to emphasize the necessity for careful training of men who undertake the work in this special field. The time has come when something more than a smattering of technic should be required of the general physician and surgeon who undertakes such work. The great fault is the failure to train men how to recognize proper indications for these special operations.—Ed.]

Report of a Death from Cocain Poisoning. A man, aged 34, was referred to A. M. Alden[2] for submucous resection of the nasal septum. Physical examination was

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(2) Laryngoscope, November, 1923.

negative except for a relaxed inguinal ring on the left side, and several bad teeth. The blood pressure was 125/80.

The usual preoperative measures were carried out except that no morphin or other drug was given. The patient was seated in the upright position. The mucosa of the septum and lateral wall of the nose was swabbed with one application of adrenalin, 1:1000. Next, the septal mucosa was anesthetized by one thorough application of 10 per cent. cocain on a cotton wound application.

Just before the operation commenced, the patient complained of a pain around his heart, and almost immediately went into a chronic convulsion with cessation of respiration. The convulsion lasted about one minute. He was immediately placed in the prone position. The pulse was very rapid and feeble, and the pupils widely dilated. Artificial respiration was started at once, and camphorated oil given by hypodermic. The heart continued to beat for several minutes, but all efforts to induce respiration were futile. An autopsy was not permitted. A quantitative examination showed the cocain solution to contain 8.65 per cent. cocain.

[Cocain is a dangerous drug and peculiar susceptibility is not so uncommon. Where such exists, only a few drops of a 1 per cent. solution applied locally will bring out unpleasant symptoms.—Ed.]

Poisons Sold by Grocers. Chevalier Jackson[3] describes and illustrates the pitiful condition of children accidentally poisoned by lye. The author presents illustrations of the labels of several popular brands of lye, showing that inscriptions, if present at all, are generally so inconspicuous that they must be illegible to persons with presbyopia or other defects of vision. Cases of accidental poisoning with rat poisons, insecticides, etc., are practically non-existent, because such preparations invariably bear a very conspicuous "scare label" with skull and cross-bones.

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(3) Atlantic Med. Jour., January, 1924.

The author urges federal and state legislation to the effect that all packages containing more than a small percentage of caustic alkali must be conspicuously labeled as "poison" with directions concerning antidotes, so as to produce a profound impression on the housewife or maid that the preparation should be kept out of the reach of children.

[Jackson is doing an important work in educating the general public as well as the profession in regard to the great danger of lye preparations.—Ed.]

Application of Diathermocoagulation in Rhinolaryngology. The apparatus and technic employed in the Beujon Hospital for the application of diathermocoagulation are described by M. L. Baldenweck[4]. The author also notes the mode of action, and the results obtained, and comes to the following conclusions. This is the method of choice for the treatment of synechias in the nose following operation. Equally good results are obtained in intranasal lupus, in angiomas and in bleeding tumors.

Diathermocoagulation offers the only method (outside of radiotherapy, perhaps) of treating, without danger, hypertrophied tonsils in subjects with disturbance of the function of blood coagulation. It may be used in diffuse papillomas of the larynx, after removal of the principal masses with forceps. Certain tumors may be benefited (epulis), but in general, in malignant tumors, it does not seem possible to expect more than palliative effects (non-hemorrhagic destruction of granulating and obstructive masses).

The treatment offers possibilities in certain circumscribed laryngeal tuberculoses, and in membraneous stenoses of the choanae. The results are varying in palatopharyngeal adhesions and in cicatricial syphilitic nasal stenoses. There can be no doubt that the indications for electrocoagulation are increasing as it is more

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(4) Arch. Internat. de laryngol., December, 1923.

used in otorhinolaryngeal practice, and with improvement in technic and the construction of special electrodes its field of application will be greatly extended.

[This is a method of treatment with definite limitation, but is an important adjunct in the treatment of certain conditions.—Ed.]

Radium in the Treatment of Malignant Tumors of the Nose and Throat. Malignant tumors of the nose and throat have proved to be the most difficult types of malignant diseases with which to deal. J. R. Ranson[5] says that the clinical course of these cases varies widely, but on the whole, their growth is rapid and dissemination is early. This is probably due to the rich vascular and lymphatic supply and to the constant irritation and movement of the parts.

The author's review of the literature shows that surgery has shown poorer results than almost any other field. The references in the current literature to the use of radium in these cases are relatively few. However, most of the reports show that in almost every case treated with radium, some beneficial results have been obtained.

Malignancies of the tongue, tonsil, and within the larynx have heretofore been classed as almost hopeless conditions, but now these conditions are combated with an increasing degree of success by burying radium needles or emanation-spicules directly into the tissues involved and radiating about the regions where glandular metastases would be expected.

Many failures have been accredited to radium which were due to inexperience and lack of sufficient knowledge as to the proper dose to be given. The results of radium treatment in malignancies depend upon whether a lethal dose is given, and also upon the susceptibility of the malignant tissue to the radium. It has been determined that certain tissues are resistant to even large doses of radiation, while others are quite

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(5) Laryngoscope, November, 1923.

susceptible and undergo resolution or retrogression with remarkably small units of beta or gamma rays.

With these facts in mind the author defines certain indications for radium, and mentions the tumors reacting favorably to radiation:

1. It might be said that radium is indicated in one form or another in all cases, either alone, pre-operative, post-operative, or as a prophylactic against recurrences.
2. When surgery is impossible or impracticable.
3. Combined with surgery when complete removal is impossible.
4. Post-operative, after surgical removal of polyps to prevent recurrence.
5. In inoperable cases to relieve pain, hemorrhage, odor, discharge and sepsis.

Radium reacts favorably on the following types of tumors:

1. Favorable influence on round and spindle cell sarcomas and lympho-sarcomas.
2. Basal cell epitheliomas yield to almost any method of application. These types can usually be clinically differentiated from other types.
3. Some squamous cell carcinomas are of high malignancy and are readily destroyed. The comparative malignancy may be determined by the rapidity of the tumor growth.
4. In leukoplakia, radium in general is the treatment of choice and this condition frequently changes into malignancy if not treated.
5. Hornifying verruca reacts to radium as if by magic.
6. Post-operative applications of radium prevent the recurrence of polyps.

[The author is more optimistic than the experience of most of us would want. Still, there is no doubt that this form of treatment has capabilities that our limited experience has not yet led us to appreciate fully. —Ed.]

DISEASES OF THE NOSE

ACUTE RHINITIS

The Common Cold. Some interesting observations are noted in the report of E. O. Jordan, J. F. Norton and William B. Sharp[6]. In this article the data is furnished by over 1,200 students at the University of Chicago, 200 at the California Institute of Technology at Pasadena, and 200 at the University of Texas Medical School, Galveston, Texas. About one-third of the University of Chicago group were women, while all the members of the other groups were men.

The term "cold" as used in this inquiry included only those conditions often termed "coryza," "catarrhal rhinitis" or "bronchitis." A questionnaire was sent to each student. In this detailed questions as to mode of living and dress, and frequency of nose and throat condions were asked. The answers are recorded in a series of comparative tables. These show that the common cold starts in the nose, about one-third extending to the chest. The sequence of the local symptoms is not uniform. There is no definite correlation between type, duration, severity and frequency of colds, except that infrequent colds tend to run a milder course. The larger majority of students reported an average of two colds a year. In the California and Galveston groups the colds tended to be concentrated into a shorter period, were of somewhat less severity and of somewhat shorter duration. In general, however, the differences in the three groups were less than might be expected on the basis of climatic conditions alone.

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(6) Jour. Infect. Dis., November, 1923.

Induction of colds by some strain on the heat regulating mechanism was reported by 64 per cent. Possible contact with others having colds was stated by 22 per cent. Contrary to expectation, the usual "resistance building" practices apparently had little effect on the frequency of colds. The data does not show that nose or throat operations result in a marked reduction in the occurrence of colds. Cultures were made on a series of University of Chicago students during, and in the interval between colds. Among the bacteria cultivable on blood agar plates, no one bacterium or group of bacteria were found to predominate in the upper respiratory tract during a cold.

Whether or not a cold is the result of a specific infectious process is unknown. It is clear, however, that outside influences, particularly those involving chilling of the body, may serve to induce a cold, even if these influences can not be regarded as the most important etiologic factors.

[This is an important contribution to the etiology of perhaps our most common enemy. The conclusions can hardly be accepted as final. Our experience has certainly shown that operations such as removal of badly infected tonsils greatly reduces susceptibility to colds. In general, however, operation in the nose has no such effect, particularly the correction of anatomical variation, like the irregularities of the septum, etc.—Ed.]

Experimental Human Inoculations with Filtered Nasal Secretions from Acute Coryza. Of the factors believed to be the exciting cause of acute coryza by the various investigators, a filtrable virus appeared to R. C. Robertson and R. L. Groves[7] to be the most promising of positive results. It was their endeavor therefore to repeat, as well as to extend, experimental work in this field, with a view to acquiring more definite data, especially in connection with the nature of any virus which might be present.

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(1) Jour. Amer. Med. Ass'n., July 7, 1923.

The selection of cases for these experiments was limited to those of uncomplicated coryza which appeared during the fall, winter, and spring; and of these the more virulent type, and therefore apparently the most infectious, was selected.

The nasal secretions of persons suffering with such coryza were collected, from 6 to 144 hours after the onset, in a container which had been thoroughly sterilized and kept from contamination so far as possible. They were mixed with sterile salt solution in varying dilutions, from 1:10 to 1:50, and the mixture was shaken with glass beads in a small jar until homogeneous and free from lumps of mucus.

A record was made of clinical data with special reference to (a) history of recent exposure to acute coryza; (b) severe chilling as the result of temperature changes or insufficient clothing; (c) evidence of contagion among associates. Smears of the secretions were then made and stained by Gram method and methylene blue.

Aerobic blood-agar plates were inoculated with a loop of this material, examined at the end of 24 and 48 hours, and the organisms identified.

The solution was then passed through a Berkefeld filter which was impermeable to ordinary cocci using tap water pressure—a procedure never taking more than one hour—and at the completion of which, smears and aerobic and anaerobic blood-agar cultures were made of the filtrate.

From the results obtained in the experiment the authors arrive at the following conclusions.

1. Because of the small number of positive results following the inoculations, it was unnecessary to employ controls. In any group of persons selected at random during a time when an endemic of colds is present, a certain small percentage will develop some upper respiratory infection within a period of 12 days. This fully explains the cases which are recorded as positive.

2. Though extensive experiments have been made on the bacteriology of acute coryza, the results obtained have been far from satisfactory. As the experiments were planned primarily to establish the status of a filtrable virus in their etiology, no human inoculations were attempted with any of the cultivated organisms.

3. In all cases examined a marked reduction of the bacterial flora occurred in the secretions with the predominance of one organism during the onset and early stages of the attack. When the secretion became purulent, usually from 36 to 48 hours from the onset, bacterial examination revealed a marked increase of the flora over the normal flora of health still with the predominance of one organism, usually Staphylococcus albus. When the secretions began to diminish, the bacterial flora diminished and gradually returned to that of health.

This is a point of some significance when considered with the negative results obtained on filtrate inoculation. Presumably it is an indication that the exciting factor is a specific, nonfiltrable organism which in some manner decreases the nasal flora during the onset and early stages of the attack, while its elimination during the course of the attack, together with its depressant action on the mucosa, permits a marked increase over the normal flora (still, however, with one predominating organism) and during convalescence a gradual return to the flora of health.

4. Although from bacteriologic examinations no satisfactory proof has as yet been produced which shows that coryzas are infections, all clinical and epidemiologic manifestations point in this direction. One has but to note the occurrence of endemics and epidemics of acute coryza in civilized communities—the absence of which has often been noted in the arctic regions by explorers—to be convinced that the specificity of these infections is as clearly apparent as in many of the acute infectious diseases of established etiology.

5. Predisposing causes, such as seasonal changes, lowered resistance, exposures to cold and moisture, and individual anatomic variations have been pointed out by many investigators and must be kept in mind at all times, as should also the clinical variations observed from the type with but slight serous discharge and no systemic effects, to the virulent type closely resembling influenza.

6. That coryzas frequently play a large part as predisposing causes of other acute or chronic infectious respiratory diseases cannot be questioned. This interrelationship is frequently seen in influenza, pneumonia, and tuberculosis, in which the onset is said to date back to "a cold," and for this reason their prevention and treatment should play an increasingly large part in modern preventive medicine.

7. In this series of experiments, nasal secretions were secured from 11 persons suffering with acute uncomplicated coryza. After being diluted and passed through a Berkefeld filter, these secretions were sprayed onto the nasal mucosa of 100 volunteers.

The experiments presented no convincing evidence indicative of a filter passing organism as the existing factor in acute coryza. The cases recorded as positive are the result of factors independent of the inoculations.

[It is very gratifying to see such a careful scientific investigation of the etiology of the "common cold." The rather extensive practice of vaccination against colds encouraged by the literature from manufacturing concerns is, to say the least, of very doubtful value, and can hardly be said to have satisfactory scientific foundation.—Ed.]

A Study of the Acute Infections of the Throat and Respiratory System. The problems involved in the occurrence and spread of the acute respiratory infections are so urgent and yet so complex that any contribution to the subject, no matter how small, has been deemed worth the publishing.

A monthly record of the acute infections of the throat and respiratory system has been kept for the last four years at the Cornell University medical adviser's office. D. F. Smiley[8] states that this record has shown, year after year, a gradual rise to a maximum number of cases in January, February or March, and a gradual fall as summer approaches. The year 1919-1920 was apparently an epidemic year for these diseases, and this was followed by a year with few such infections. The year 1921-1922 shows a slightly increasing prevalence, and 1922-1923 shows the infections again assuming epidemic proportions.

The author gave the Cornell University men questionnaires in which they were asked questions as to smoking, mouth breathing, sleep, footwear, clothing, exercise, etc. The results are tabulated in several tables and the author comes to the following guarded conclusions.

1. Tobacco, dust, gas, mouth breathing, sleep, drafts, constipation, perspiration, bathing and footwear are apparently not major factors in determining resistance to respiratory infections in this particular group.

2. Exercise appears as a liability rather than an asset in this group (probably because of improper care of the body in the stage of fatigue following the usual violent sport).

3. The use of woolen underwear is apparently no panacea for the prevention of "colds"; in fact, it seems almost safe to infer that the use of light underwear is preferable under conditions obtaining at Ithaca.

4. Heredity may be a factor in determining resistance through carrying on to the next generation a "catarrhal diathesis" or the opposite.

5. Since removal of nasal obstructions and diseased tonsils in more than half of the "four or more" group has not resulted in the reduction of the frequent "colds,"

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(8) Jour. Amer. Med Ass'n., Feb. 16, 1924.

it seems fair to conclude that nasal obstructions and diseased tonsils are not major factors in the majority of persons suffering with frequent "colds."

6. Of all the factors listed, only one (that of underclothing) showed a difference of more than 15 per cent. in the two groups, and that only 19 per cent. It might be concluded, therefore, that, though underwear is of some importance, no major factor has been dealt with in the whole questionnaire.

What the major factors in susceptibility to "colds" are is, therefore, as far as the work at Cornell University is concerned, still a matter of conjecture. There is an inclination toward the supposition that there is a specific lack of immunity in certain persons to the organism or organisms that cause "colds"; but until the etiology of these infections is definitely settled, a specific prophylactic cannot be looked for.

As a test of the prophylactic value of the present respiratory vaccines, a small number of the "four or more" group was inoculated once a month with one of the much used types of respiratory vaccines on the market, but no reduction in frequency of "colds" was noted in the majority of cases. Investigation along this line seems to offer some hope of success, however, and the therapeutic inoculation of a large number of patients, while they are suffering from "colds," will probably be attempted the coming year. The objective will be to prevent severity, prolongation and complication (so often caused by the known secondary invaders). On theoretical grounds, at least, such an objective is not impossible of attainment if the respiratory vaccines are considered capable of combating the known secondary invaders; and if it is considered that the unknown virus itself (which we may assume is the true etiologic factor) is capable of running only a mild course.

[Such careful investigation will develop step by step an insight into the cause of, and no doubt the better treatment of, this prevalent malady.—Ed.]

The Importance of Early Treatment of Chronic Nasal Catarrh or Chronic Inflammation of the Nose Proper. J. K. Guthrie[9] states that nasal catarrh is seldom given the consideration that is due it. This condition, when neglected, is very apt to cause several of the following results:

1. The patient is subject to great discomfort and annoyance.

2. Anemia or general systemic depression or both are present, due to an abnormal exchange in the lungs of oxygen from the improperly prepared air and carbon dioxide from the blood. This abnormal exchange results in impoverishment of the blood and consequent faulty and insufficient metabolism. Anemia, loss of weight and debility follow.

3. Locally, increase in tissue occurs, thus creating a vicious circle by increasing obstruction to the passage of air through the nose.

4. Contiguously both congestion and purulent inflammation develop.

(a) Congestions and irritations of the sinuses with the attending symptoms, some of which, such as dizziness and headache, may render the patient's life miserable. Congestion and irritation of the conjunctiva, pharynx, larynx, bronchi or ear and perhaps of the brain and interior of the eye, pave the way for future trouble such as purulent sinusitis, follicular pharyngitis, chronic laryngitis, persistent bronchitis, incurable deafness, and mental irritability.

(b) Purulent inflammation of the sinuses with their complications such as nasal polypi, in some cases completely occlude the nose and deprive the patient entirely of the sense of smell. This is very disagreeable and not without danger.

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(9) Jour. Iowa State Med. Soc., January, 1924.

5. As a direct result of the disease an acute and chronic purulent and non-purulent middle ear inflammation may occur, which may result in deafness, or in case of the purulent type, complications which frequently cause disaster. When these cases, especially of catarrhal deafness, call for help they have done so as a rule thirty years too late, and often when they can be helped but little if at all. Neither is this surprising any more than that we do not get very brilliant results in cases of chronic interstitial nephritis or cirrhosis of the liver with a thirty year pathology. And the condition could have been prevented if its precursor had been given the proper attention whether on the part of the doctor or the patient. This applies especially to chronic otitis media.

There is an enormous number of people distributed everywhere who have nasal catarrh and take it as a matter of course or thinking of their acquaintances who have consulted a physician with little encouragement of relief, give up hope of being cured.

On the other hand, nearly every case is ultimately serious as to the function of some important and almost essential organ, or as to longevity. Nearly every case if properly treated early is easily curable with almost no risk to the patient and in the ordinary course of events with perfect results. Impaired vision, impaired hearing, impaired speaking, bronchial disease or general debility, one or all are sure to follow in the wake of this supposedly unavoidable, supposedly incurable and unimportant malady.

The chance in the late stages for a perfect, or nearly perfect nose is small. They can be greatly benefited in the later stages, especially where there is constant formation and partial retention of pus—some even with apparently perfect results. Even after violent complications have arrived a few are saved by intervention. But they are certainly anything but desirable cases.

The cause is usually mechanical and the treatment purely surgical with a few exceptions, due to some constitutional dyscrasia. The cause is one or two things in origin, simple obstruction with decreased air passage or negative pressure and usually both, depending on the site of the obstruction. Negative pressure occurs with a forward obstruction not with a posterior obstruction and with consequent congestion and inflammation.

The cause is not a soft swelling in the nose, which is so frequently cauterized with temporary benefit. Neither is it an enlarged inferior turbinate bone so frequently removed with actual damage to the nose and to the patient. These things are early and late results respectively of the disease. This soft swelling so frequently seen is entirely away from the seat of the trouble, and to expect a cure from its cauterization is as sensible as to expect to remove the obstruction to a stream of water by taking drift wood off the top of a concrete dam. The same is true of the enlarged inferior turbinate. The soft swelling is usually the result of negative pressure beyond and at the swelling, and the enlarged turbinate follows the inflammation due to the soft swelling or follows sinusitis with its irritating secretion or follows pressure irritation of air or tissue.

More specifically, the cause in the great majority of cases is a misshapen septum, whether bent, thickened or spurred, fairly often and, primarily, enlarged middle turbinates sometimes called cystic or an abnormally small nose. Of course, climate plays a part in these cases, but climate is only rarely the primary cause and usually is simply the additional weight in the scales already overbalanced against the patient, to a slight extent perhaps.

The thing that requires treatment is not merely an anatomical defect but an anatomical defect that causes a pathological condition; an obstruction rather than merely an asymmetrical nose. The early treatment in nearly all cases consists in a partial submucous resection of the nasal septum or middle turbinectomy, or both. In quite a few cases only a part of the middle turbinate need be removed. Sufficient tissue is removed to relieve the obstruction to breathing and to sinus ventilation.

The small nose seems to the author to be the one almost, or quite incurable condition. Possibly an early adenectomy might increase the sizes of these noses by increasing the amount of work they have to do.

It is very important that adenoids and tonsils be thoroughly removed and that other structures be left intact. It is a disconcertingly common thing to hear people say, "So and so had his tonsils out and was worse afterwards than before. I don't believe in taking them out." The reason is apparent to any one who sees the throats of these unfortunate patients.

[The statements made in this article are rather dogmatic and can hardly be accepted on actual definite proof, which is lacking. For example, chronic catarrhal otitis media is on the whole rather an unusual condition and is not apparently dependent on nasal obstrucitons, at least not those caused by such anatomical variations as the irregularities of the nasal septum.

Recurrent coryza is apparently as frequent in open as in obstructed nasal passages, and is usually associated with some acute sinusitis. In those cases where the normal ventilation of the sinuses is obstructed by a high deflection of the septum the correction of the latter by a resection of the concha media permits the more rapid recovery of the acute process.—Ed.]

Keeping the Child's Nose Clean by Aspiration. W. D. Rowland[1] says that there are many conditions of uncleanliness and pathologic conditions in young children which are poorly cared for because of faulty drainage of the nose. W. B. Mason's ear and nose syringe is of great value in applying nasal suction. The author has used the same type of syringe for aspiration with great ease and comfort to the patient, and

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(1) Jour. Amer. Med. Ass'n, July 7, 1923.

most satisfactory results by completely cleaning the nose in coryza. In the presence of pathologic conditions, the aspiration with this instrument will oftentimes avoid middle ear involvement. It may be used both for irrigation and for aspiration because the negative pressure secured by compressing the bulb and fitting the blunt end of the instrument securely into the nose is sufficient to draw secretions all the way from the pharynx and postsinus areas.

The syringe which the author has used has a glass barrel 5 inches in length, a diameter of three-fourths inch and a curved blunt tip one-fourth inch in diameter. This syringe has all the advantages mentioned by Mason, namely, it is inexpensive, simple in construction, easy to sterilize, may be manipulated with one hand, and, above all, is most agreeable to the child at an age when procedures of this sort are distasteful to them. It has been a most satisfactory agent and the author feels that pediatricians and others caring for children will find it a very helpful thing in keeping the child's nose clean.

[Suction treatment to free the nose of secretion is better than the attempt to syringe any such accumulation. It should be free from risk of producing middle ear infection, which any method of syringing, particularly in children, carries with it.—Ed.]

The Relations of the Olfactory Sense to the Larynx. A Contribution to the Physiology of the Sense of Smell. E. V. Ullman[2] has found that in all cases of laryngectomy complete loss of the power to perceive odors resulted. When an atomizer is used, the patients are able to smell, but the stimulus is not transmitted so accurately or so regularly as under normal conditions. The author believes that mechanical causes produce changes in the sense of smell after laryngectomy.

Since these patients are able to expel smoke through the nose, some factor in addition to the eliminated oronasal breathing must explain the loss of sense of smell.

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(2) Ztschr. f. Hals, Nasen u .Ohrenhlk., 6::570, 1923.

Tracheotomized patients can smell spontaneously, as can also patients with laryngeal stenosis. This shows that the eliminated nasal breathing cannot be the sole cause of anosmia after laryngectomy. Patients with laryngeal stenosis strongly depress the floor of the mouth and the larynx when smelling, and fix the larynx in this position. When a faint odor is to be perceived, it becomes necessary even in normal subjects to stretch the musculature from the floor of the mouth to the hyoid bone, thereby changing the shape of the oral cavity and pharynx.

The author concludes that anosmia after laryngectomy is caused by the patient's inability to render tense the musculature of the floor of the mouth.

Immediate and Late Treatment of Nasal Fractures. Recognition of nasal fractures presents little real difficulty, according to L. Cohen.[3] Mere inspection often suffices, even without palpation and manipulation through which crepitus and undue mobility seal the diagnosis. *X*-ray examination, owing to the superficial position of the nasal bones, is superfluous, as fracture without displacement, so frequently reported by the roentgenologist, requires no surgical intervention.

The author advocates setting of a fractured nose as soon after the injury as possible. This is accomplished by simply lifting the depressed fragments of nasal bones into place, setting the fractured bony septum in the mid-line, and retaining them by the use of gauze packing within, with a copper splint, lined with surgeon's lint, on the outside of the nose. Where the bone of one side is completely fractured along with the bony septum and the fellow nasal bone only slightly cracked, setting is not so simple. In such cases the entire nose must be mobilized with Adams forceps, and possibly hammer, before setting in position.

The author reports three cases, illustrating immediate repair of the nose and also the greater amount of work

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(3) Laryngoscope, November, 1923.

required in cases of long standing. From the results obtained in these cases the author comes to the following conclusions.

1. Setting of a fractured nose should follow as soon after injury as possible.

2. Local anesthesia may be used in adults, except in the presence of excessive swelling and infiltration of soft tissues, or when the fracture is complicated by wounds of the skin. In such instances infection would be more likely to follow injection of local anesthesia, and ether is therefore safer. For children ether is, of course, always employed.

3. Wounds of the skin, after thorough cleansing, may be sewed, and in no way contra-indicate the immediate application of the splint, when the patient is seen soon after the accident and prior to any infection. Before applying the splint in such instances, however, a fold of sterile handkerchief gauze of four or five layers, should be laid smoothly over the nose to protect the wound.

4. Due consideration to asepsis by the thorough cleaning of the nose, internally as well as externally, eliminates danger of infection.

Nasal Fractures. Their Treatment by a New Adjustable Splint. S. Salinger* presents an apparatus devised to provide the four principal features essential for proper immobilization of the nose: (1) a definite method of fixation which is constant; (2) pressure from within the nose; (3) counter pressure against the sides of the nose; (4) adjustment to fit any size or shape of nose.

The splint consists of a slightly curved metal plate, in the center of which is a projecting bar about one-half inch long, which supports a round metal bar about 3 inches in length. The plate is embedded in a plaster bandage placed about the head from just above the eyebrows to well below the occiput, so that the post is as

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(*) Ann. Otol., Rhinol., and Laryngol., June, 1924.

nearly as possible on a line drawn from the center of the root of the nose to the middle of the lip and the horizontal bar at right angles to this line.

On each half of the bar is a sliding block surmounted by a set screw. These blocks are perforated to receive a round metal rod, which runs parallel to the nose and is long enough to reach the upper lip. At the distal end of the rod is a thin rubber covered metal bar, so hinged and controlled by a screw as to be adjustable at various angles to the long supporting rod.

The thin bar is to be inserted into the nose against the inner surface of the bridge, in the angle between the roof and the septum. Along the metal rod is another sliding block with a set crew, and perforated to carry a thin adjustable rod with a thick felt pad at its end, which is to furnish the counter pressure against the side of the nose or against the molar bone as required.

Abscesses of the Nasal Septum; Their Etiology and Treatment with Reference to Resulting Deformities. According to W. W. Carter,[4] acute abscesses of the septum are invariably due to trauma. The condition is slow and insidious in its development. An abrupt thickening of the septum just behind the columellas with the septum posterior to this being swollen and inflamed, is an almost pathognomonic sign.

The author advises treatment as early as possible, and recommends the following procedure. An L-shaped incision is made on the left side, the long arm corresponding to the anterior border of the septum and the short arm being extended backward along the floor of the nose. The incision is made freely into the abscess cavity. After being washed out with salt solution and swabbed dry with absorbent cotton, the cavity is swabbed with carbolic acid, followed immediately by alcohol. A gold wire splint is then introduced into each nasal fossa.

The only satisfactory correction of a saddle-back deformity is by the transplantation of autogenous bone

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(4) Med. Jour. and Record, Feb. 6, 1924.

and cartilage grafts. The author emphasizes the desirability of doing the corrective work intranasally, chiefly because infection is less likely to occur and there remains no disfiguring scar.

A Modification of the Ballenger Swivel Knife and Anterior Mucous Membrane Separator. A. J. Shekter[5] states that every now and then one runs up against a case where it becomes necessary to dissect out a piece of cartilage anterior to the initial incision. Whether this becomes necessary because the initial incision was made too far back or because of peculiar deflection or dislocation, the fact remains that we do meet with just such cases.

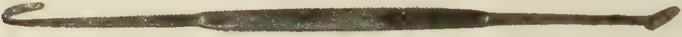

Fig. 14.—Anterior mucous membrane separator.

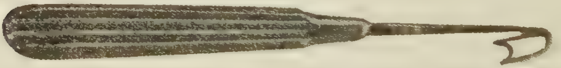

Fig. 15.—Skekter-Ballinger swivel knife.

Two instruments were devised to meet such conditions. The anterior mucous membrane separator will separate the mucous membrane anteriorly to the initial line of incision and the modified swivel knife will cut from behind forward. The author is sure these two instruments will prove valuable to the nose and throat specialist.

The Treatment of Nasal Obstruction by Submucous Resection of the Inferior Turbinate Bone. Report of Cases. According to W. Spielberg[6] the nasal condition which annoys patients most of all is difficulty in breathing freely through the nose. The author confines his discussion of the subject to nasal obstruction due to hypertrophy of the inferior turbinate.

Enlargement of the inferior turbinate is a physiologic filling and emptying of the venous plexuses in the submucous tissue of the membrane of the nose. Irritation causes temporary swelling of the turbinate. General

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(5) Laryngoscope, March, 1924.
(6) Laryngoscope, March, 1924.

venous congestion and sedentary habits are frequently causes of enlarged inferior turbinates. Compensatory or unilateral enlargements are found with a pronounced deviation of the nasal septum, the opposite turbinate being retracted and very small. Frequently the enlargements become chronic, and give rise to true hypertrophic and hyperplastic changes in the turbinal mucosa.

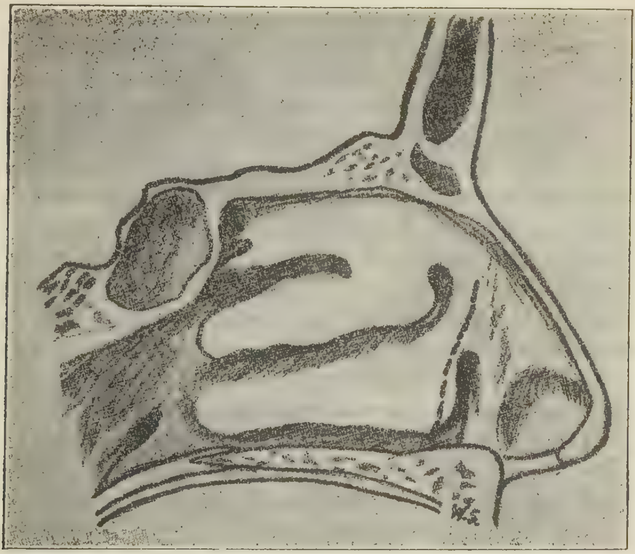

Fig. 16.—Dotted line shows the incision made for the submucous resection of the inferior turbinate bone.

Pathological changes in the bony framework of the inferior turbinate also leads to its enlargement. The author finds it difficult to make a practical classification of hypertrophy of the turbinate. All cases, however, are characterized by being associated with certain symptoms, clinical findings, and a history of remittent or intermittent nasal obstruction. The obstruction appears and disappears quickly, and when the patient is lying down, affects the lower side. On examination the turbinate may be found enlarged or not, but the latter should not be construed as a negative finding.

The author believes that many of these cases have been over-operated. He also thinks that submucous resection of the septum is unsatisfactory in most cases. Because of this he has performed submucous turbinectomy in a series of 20 patients and with a cure in each instance. The author's technic is as follows. Local anesthesia is most satisfactory. The turbinate is surrounded with pledgets of cotton moistened with a solution of equal parts cocain (10 per cent.) and adrenalin (1:1000), and left in for twenty minutes.

1. A vertical incision is made beginning high up above the anterior attachment of the inferior turbinate and along the pyriform aperture, going through the mucosa and periosteum and well down to the bone, carried down along the entire anterior border of the turbinate.

2. The success of the operation depends largely upon separating at the proper layer in order to get sufficient elevation of mucosa. It is absolutely necessary to get between the periosteum and bone when first beginning the separation. Starting with a sharp Freer elevator, the mucosa and periosteum are elevated beginning at the upper angle of the incision, first extending backward, then downward along the inner surface of the turbinate to its lower dependent border. When the right layer is struck one experiences the same sensation in its separation as when elevating the muco-periosteum in the septum operation. There should be very little or no bleeding and tearing of mucosa. To avoid the latter, a blunt Halle elevator is used in separating as soon as the right layer is struck with the sharp elevator. The mucosa and periosteum are then elevated from the outer surface of the turbinate, by either passing around the inferior border of the bone, or starting separation along the anterior free border of the bone exposed by the incision.

3. The bony lamina freed from its covering, and now actually suspended in a sac of mucous membrane, is detached from its base with a long thin scissors. The bone, if entirely freed from its covering and attachment, will

drop into the sac and can be removed with any forceps. If still attached to the mucosa posteriorly it can be easily removed by grasping it with a forceps and slowly with a slight jerky motion extracted. If it is not desirable to remove the entire bony lamina, small parts of it can be bittten away with a sharp biting forceps. The incisions can be closed with a single silk suture if one desires. The nose is then packed with a Simpson intra-nasal tampon.

The post-operative treatment consists in removing the packing in 48 hours and cleansing the nose for a few days with some bland solution. Healing takes place very quickly; in two or three days there is no sign left of the incision. The disagreeable nasal discharges, scabbing and crust formation are conspicuous by their absence. The preserved muco-periosteum forms a miniature turbinate, thus preventing atrophy of the turbinal mucosa. The result is apparent the first week post-operative.

[This method of relieving annoying nasal obstruction appeals to us. It certainly is more efficient than the correction of most irregularities of the septum and since it does not destroy the mucous membrane it is free from the objection properly urged against the ordinary inferior turbinectomy.—Ed.]

Submucous Resection of the Nasal Septum in Children. F. W. White* reports a series of operations performed on children, the average age being just over 10 years, the youngest 4. Trauma was the cause in about 50 per cent. of the cases. High palatal arches were observed in about 25 per cent. of the patients. In no patient has any post-operative deformity been noted. As a result of the operation the children changed from mouth to nose breathing, and their faces became rounded and animated instead of long and stupid as before.

The author offers the following conclusions. (1) The number of cases of intranasal obstruction, deviations and spurs, and sinusitis, is increasing. (2) Treatment

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(*) Ann. Otol., Rhinol., and Laryngol., June, 1924.

may be either preventive or surgical. (3) There is no denying the ultimate ill effects of nasal obstruction in young subjects. (4) The time has come to eliminate the bias against performing submucous resection of the nasal septum in children provided the typical operation is modified to coincide with the exigencies of the case under consideration.

Epistaxis Leading to the Diagnosis of Scurvy and a Review of the Subject of Epistaxis. A woman, aged 60, was referred to A. Lobell[7] because of frequent epistaxis. There was also a history of edema of the legs, some tenderness of the calves, excruciating pains in the extremities, extensive pyorrhea, loss of weight, and anemia. On questioning the patient admitted that for two years she had totally abstained from all fruits and vegetables in any form. The idea of scurvy came promptly to the surface, and what had been an obscure case for several years, now became quite apparent. On the administration of anti-scorbutic food the nasal bleeding ceased very quickly.

The author emphasizes that this case clearly demonstrates that the sphere of the rhinologist is not limited to the narrow boundaries of the nasal fossa. It shows that he must possess a comprehensive knowledge of the various diseases that cause epistaxis.

The various causes of epistaxis are:

1. Diseased conditions occurring in the nasal structures. Ulcerations and erosions of the septum and other areas in the nose, nasal diphtheria, adenoids, foreign bodies, syphilis, tuberculosis, rhinoscleroma, carcinoma, epithelioma, sarcoma, angioma, and all forms of trauma including fractures of the skull and all types of postoperative hemorrhages.

2. Diseases of the cardio-vascular-renal system. Arterio-sclerosis, chronic nephritis, high blood pressure caused by any abnormality in the system; venous stasis,

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(7) Laryngoscope, March, 1924.

as in cirrhosis of the liver, caisson disease, cavernous sinus thrombosis, pertussis, ascension to very high altitudes, etc.

3. Diseases of the blood cells, blood plasma and blood forming organs. Changes in the red cells, as in primary and severe secondary anemia, erythrocytosis with or without splenic enlargement, lymphatic and splenomyelogenous leukemia, hemophilia, purpura hemorrhagica, and scurvy.

4. Some of the diseases of bacterial origin. Typhoid, cerebro-spinal meningitis, diphtheria (not of nasal origin, but due to toxemia), measles, scarlet fever, pertussis, erysipelas, small-pox, pneumonia, malaria, septicemia, pyemia, etc.

5. The absorption of poisonous substances into the system. Among these may be enumerated, acute and chronic phosphorus and mercurial poisoning, ergot, and certain types of auto-intoxication.

The most frequent bleeding points are on the anterior part of the septum, the floor of the nose at the nares, in the sulcus where the septum joins the floor.

Diagnosis. The diagnosis is usually simple. However, to rule out hematemesis, or blood originating in the lungs, a careful examination of the nose should be made.

Prognosis. The prognosis of epistaxis will naturally depend on the type, the etiological factor, and the associating diseases that one would encounter in a given case. The great majority of hemorrhages are easily controlled. Fatal cases do occur but unfortunately these cases are not often recorded in the literature. Freudenthal reported a fatality of a case of epistaxis due to telangiectasis of heredity type. The cases that threaten life are those that are caused by hemophilia and do not respond to the serum injections and transfusions; certain hereditary types, the telangiectatic types; and in rare instances, cases of uncontrollable hemorrhages occur after extensive intranasal operations and where there is no history or demonstrable evidence of hemophilia.

Treatment. The first essential in the treatment is to discover the cause of the bleeding. In every case of recurrent hemorrhage of the nose a careful general medical and laboratory examination is indicated. Bleeding that is not controllable by the ordinary home methods requires cauterization. Anterior and posterior packings (the packing saturated in sterile petrolatum) are still the best methods of arresting hemorrhage. Suturing is the ideal method in a severe spurting hemorrhage, provided it occurs in an accessible region.

Roentgen Therapy in the Treatment of Nasal Polypi. During the past two years J. G. Ware[8] has treated 16 cases of nasal polypi by roentgen therapy. Four to six treatments at one-week intervals are given. Rays are directed over the nose and up into the posterior sinuses, through an opening in a sheet of lead foil, approximately 2½ in. in diameter. The head is slightly turned to one side as each dose of four minutes' duration is given.

It is always advisable to make an *x*-ray examination of the antra before beginning treatment. Not infrequently nasal polypi will be associated with multiple polypi of the maxillary antra, the plates showing a marked density of these sinuses. Treatment of the nasal polypi alone will give very little relief. The author's experience leads him to believe that if the polypoid growths in the antra are surgically removed, followed by *x*-ray treatment, excellent results will be obtained.

Under certain conditions, purulent sinus inflammations will give rise to the formation of myxomata or edematous nasal polypi. They are usually associated with inflammatory changes in the sphenoid cells; less

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(8) Amer. Jour. Roentgenol., July, 1923.

commonly with the ethmoids and maxillary antra. They usually spring from the sphenoidal ostium or the ostium maxillare, and occasionally from the middle turbinate or ethmoids. On rare occasions one may be observed attached to the nasal septum. They are rarely seen in persons under the age of puberty.

Nasal polypi are usually fibromyxomata, being composed of edematous mucous membrane, containing the usual inflammatory products. A covering of epithelium surrounds the sac and is supplied by a few blood-vessels and nerve filaments. They may be single, multiple, pedunculated or sessile. They may be large enough to fill the entire nasal chamber, or extremely small, appearing like a cluster of minute grapes.

The patient usually complains of nasal obstruction and watery discharge, or may have occasional attacks of acute rhinitis. Headaches, asthma and attacks of sneezing are not uncommon. The quality of the voice is changed, due to the obstruction of the nasal passage.

Surgical intervention is not always successful, the polypi recurring times without number.

The treatment of polypi by roentgen rays followed closely the technic employed first by Witherbee in the treatment of tonsils. The following factors are used: 3 mm. of aluminum; 8-in. sp. gap; 5 ma.; 10-in. distance; four min. to each side.

The author reports three cases in detail, which showed remarkable improvement in nasal symptoms following a few doses of roentgen therapy. Previously, surgical intervention had failed to relieve the condition. The author has found that four treatments, one week apart, are usually sufficient. He states, in conclusion, that while it is too early to predict the final outcome, it is hoped the results will be permanent.

[The treatment of this hyperplastic ethmoiditis by radium or the roentgen rays has been frequently suggested. It would seem that the application of radium should give more certain results than the radiation treatment. Our experience with the latter has not as yet been very satisfactory, probably because we may not have acquired sufficient skill in dosage.—Ed.]

Some of the More Recent Problems in Rhinology. The conscientious rhinologist is anxious not only to avoid the risk of indiscriminate, unnecessary surgery, but to make sure that everything possible is being done for his patient. Accordingly, G. E. Shambaugh* feels that certain problems of etiology become important.

Vacuum headaches have been attributed to closure of the frontal sinus; if this is the case they should appear in advanced hyperplastic ethmoiditis with development of polypi completely closing the middle meatus, but the author has not found headache a frequent symptom cf this condition. Cases of sphenopalatine neuralgia have been attributed to hyperplastic changes in the underlying bone from alterations in the nasal mucosa. However, the author cites cases where it was secondary to distant focal infection.

It is claimed that optic neuritis may be due to sinusitis or ethmoiditis, even when disease here is not demonstrable. The rhinologist may be asked to operate because in some cases the optic neuritis has subsided after a similar operation. If the neuritis or sinusitis is severe the operation should be performed, but when both are mild there will probably be a spontaneous recovery. If such recovery does not take place operation should again be considered. The author believes, however, that the importance of focal infection in the causation of headaches, sphenopalatine neuralgia and optic neuritis has been overlooked in order to fix on them an etiology primarily rhinologic, which would tend to useless operations.

Deficient Vitamin Diets as a Factor in Otolaryngological Conditions. J. A. Stucky* discusses some of

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(*) Minn. Med., July, 1924.
(*) Laryngoscope, August, 1924.

the results obtained on laboratory animals by the feeding of various diets. In the tests, the tonsils in the cat fed the high fat and high calorie diet were 50 per cent. larger than in the cat fed high calorie normal fat, and twice as large as the cat fed normal calories and high fat.

These experiments show that lymphoid tissue located in the bucco-pharyngeal cavity is regulated by the calorie content, and especially the fat content of the diet. High calorie will cause a marked increase in the amount of tissue, but the increase will be decidedly larger if the excess of calories are given in the form of fat. The facts show that diet cannot be ignored as a possible factor in enlarged tonsils and adenoids. The author's clinical experience is in accordance with this view.

OZENA

The Frequency of Ozena in Different Countries. From the reports of individual authors in almost all the countries of Europe, A. Alexander[9] finds that in Russian Poland a strikingly large number of ozena patients are Jews, and also that ozena is particularly frequent in Roumania. In Spain, fetid atrophic rhinitis has become a social evil; in Italy it is relatively rare except in Turin, where it is comparatively more frequent. In northern England ozena is found with great frequency.

In America the condition is quite frequent in Kansas City, and along the shores of the Great Lakes. In Africa and New Guinea ozena is rarely found. The author points out that on the basis of statistical observations the theory that he formerly advocated must be admitted, namely, that in pronounced cases of ozena beginning in early youth the cranial measurements are influenced in the direction of chemoproscopy by growth disturbances of the diseased bones of the face.

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(9) Folia Oto-Laryngol., December, 1923.

J. N. Roy traveled extensively in parts of the earth inhabited by black races, but did not find any cases of ozena among negroes or mulattoes, Hottentots, Bushmen, Somalis, Abyssinians, negroes of Australia or of the West Indies. On the other hand many cases occur among the negroes of Brazil and the United States. The yellow races of Asia seem to be especially predisposed to atrophic rhinitis.

The disease is rarely found where the natives live in the open air, but is found more frequently in cities. The author emphasizes the importance of settling the question of the frequency of ozena as soon as possible. Every case of atrophy with scabs and fetor should be classified as ozena, with the exception of necrotic processes of syphilitic origin. The different races in different countries should also be considered.

The Surgical Treatment of Ozena. J. A. Glassburg[1] states that the success of treatment depends upon the proper selection of the case which, in turn, depends upon the etiology. Ozena is really a symptom and not a special disease.

The etiological classification of ozena is as follows:

1. General.—a. Malnutrition. b. Constitutional diseases. c. Physiological atrophy of old age.

2. Local.—a. Congenital malformations. b. Postoperative atrophy. c. Mechanical obstruction. d. Infections and sinus diseases.

3. Neurotrophic.

From a therapeutic viewpoint ozena may be considered under two categories, surgical and non-surgical. The surgical types are those due to mechanical obstructions, diseases of the accessory nasal sinuses, and some of the varieties of the congenital malformations. The non-surgical types are those due to malnutrition, constitutional diseases, the physiological atrophy of old age, and postoperative atrophy. Some of the post-operative atrophies do at times respond to surgery of the inferior

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(1) Med. Jour. and Record, Mar. 5, 1924.

turbinates, as shown by the paraffin injections and resection and fracture of these structures. The type of ozena that gives the most satisfactory results after operation is that due to diseases of the sinuses, or to a mechanical obstruction caused by a deviated septum, or hypertrophied middle turbinates. To illustrate the effect of treatment in these conditions, the author reports the results of four cases. In each case the foul smelling crusts disappeared after removing the diseased turbinate tissue, polypi, and providing adequate drainage for infected sinuses. The author concludes by saying that in ozena we have a most difficult and baffling disease to cure, but there is one form of it, namely, that due to sinus disease which is amenable to treatment. Medical means, washes, oils, vaccines and topical applications are practically useless, so far as a permanent cure is concerned. The only form of treatment in this condition is surgical and based on the well established and time honored principle that "wherever there is pus evacuate."

[We have found the condition of ozena only associated with a well advanced atrophic nasal process. The only surgical removal of tissue that shows favorable influence on this condition is that directed to improving drainage from the ethmoid and other sinuses.—Ed.]

Report of a Case Showing the Results of the Halle and the Lautenschlager Operations for Ozena. W. Mithoeffer[2] reports a case in which these operations were performed, and describes the technique of each.

Miss H., age 19, was first seen Feb. 21, 1921. At this time she was complaining of an odor from the nose and nasal discharge, both of which had existed for at least seven years. Nasal examination showed the usual atrophic mucous membrane and offensive crusts of ozena. The turbinate bones, especially the inferior, were greatly atrophied. The blood Wassermann was negative.

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(2) Laryngoscope, December, 1923.

Conservative treatment was used for some time without relieving the patient of a severe supra-orbital headache. On January 31, 1922, an intra-nasal ethmo-frontal operation relieved the patient of the headaches, but the crust formation and odor continued. On December 9, 1922, the Halle operation for ozena was done on the left side.

Technic of Halle Operation. The inferior turbinate and that portion of the septum lying opposite are scarified; an incision is made on the lateral wall of the nose from the anterior end of the middle turbinate to the anterior end of the inferior turbinate. Another incision is made along the floor of the nose joining the incision at the anterior end of the inferior turbinate. The mucous membrane is now elevated along the floor of the nose and on the lateral wall underneath the inferior turbinate. A chisel is now placed in the incision on the lateral wall and an opening made into the antrum at the most anterior portion of the incision. After an opening is made, the bone is further severed along the entire length of the naso-antral wall, being careful, however, not to penetrate the bone completely in the region of the middle turbinate for fear of injuring the lachrymal apparatus. The chisel is now placed underneath the dissected mucous membrane on the floor of the nose and the wall of the antrum severed along the entire length corresponding to the naso-antral floor. A large sized periosteal elevator is now placed through the upper opening made into the bone and the lateral wall displaced into the nasal cavity. When this is done a view of the antrum and ethmoid is easily obtained. The antrum, if diseased, is then curetted and the ethmoid cells exentrated. The antrum is packed with iodoform gauze beginning above and packing as tight as possible. If reaction is not very severe the packing is allowed to remain six days. Dressings are changed every fourth or fifth day for at least a month. If the operation is properly done the inferior turbinate will be in close contact with the septum and a synechia will result. It is not advisable to divide the synechia as the nasal obstruction which is present immediately after the operation slowly disappears with the occurrence of a slight recession of the naso-antral wall

The result of this operation in the case reported has been fairly satisfactory.

On the suggestion of Dr. J. Maliniak it was decided to operate on the right side by the Lautenschlager method. The technic as employed is as follows. 1. Incision was made under local anesthesia along the alveolar ridge; the incision was a little longer than the one employed in the Denker operation and also was placed a little lower on the alveolar ridge. 2. After careful dissection of soft parts and periosteum, two rhomboid pieces of bone about one-half inch long were removed from the antral wall of the superior maxillary bone. These pieces of bone after being carefully shaped were placed aside for future transplants. 3. The antrum cavity was curetted and a large amount of hyperplastic tissue removed. 4. With a large periosteal elevator the naso-antral wall in the region of the middle meatus and ethmoid region was infracted toward the septum. 5. The ethmoid cells were next curetted through the antrum opening. The sphenoid cavity was diseased and was also dealt with. A small flap of nasal mucosa was placed into the antrum in the region of the natural orifice to insure good ventilation of the cavity.

6. The nasal mucous membrane on the floor and underneath the inferior turbinate was carefully elevated, beginning the dissection at the apertura pyriformis. One of the bone transplants taken from the facial wall was placed over the floor, the other underneath the inferior turbinate on the lateral wall. 7. A flap of buccal mucous membrane with the base of the flap covering the apertura pyriformis was placed in the antrum and the cavity packed with iodoform gauze. The first packing remained

six days. The cavity was packed for four weeks, when healthy epithelium had covered the antrum wall. The edges of the antrum were then refreshed and the cavity closed.

The results in the case reported, six months after the first operation and two months after the second operation, were very satisfactory. Crust formation has entirely ceased on the right side and nearly so on the left side. The odor has disappeared. The author believes that the Lautenschlager operation is more apt to give good results than the Halle.

The Nasal Accessory Sinuses

Evolution of the Nasal Cavities and Sinuses in Relation to Function. The comparative anatomy of the nasal cavities and sinuses is traced by J. F. O'Malley[3] in the vertebrate group of craniata, beginning with the lamprey, through the fishes, amphibia, reptiles, birds, and lower mammals to man. Many interesting phases of progression and regression are shown.

The nose is first apparently an organ of smell only. Later it becomes related to taste and assimilation, and then to respiration. As this latter function predominates, the more primitive function of olfaction recedes. The specialized structure of the adult of a lower class becomes vestigial in the adult of a higher class, but in the developing embryo of the latter it is always reproduced. Before the formation of the permanent palate establishes the nose of the mammalian types, the human fetus goes through the phases which are found in the lamprey, dog-fish, amphibia, reptiles, and birds. At this stage, and even later, characteristics which belong to the adult among lower mammals are seen. Ascending in

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(3) Jour. Laryngol. and Otol., February, 1924.

the scale from water to air breathers, the phylogenetic variations of the nose are intimately related to the evolution of the face and mouth.

Three distinct stages are reproduced in the development of the human embryo: a piscine, in which the nose and mouth are formed independently; an amphibian stage, where the nasal respiratory passage opens on the roof of the mouth; and a mammalian stage, in which it opens into the nasopharynx. Certain physiologic and anatomic data both support and negate the view that the turbinates and meatuses, though they increase the olfactory area, are developed in connection with respiration, in order to filter and warm the inspired air.

The largest number of turbinates are found in those air breathing animals with a keen sense of smell, yet the relative distribution of olfactory and respiratory epithelium shows that the latter predominates. In amphibia and reptiles the turbinates are situated in the olfactory portion of the nasal chamber only and are covered by true sensory epithelium, yet the sense of smell is poorly developed in most of them. The shark, with no turbinates, has an extremely keen sense of smell, by which he lives. Birds, on the other hand, have poorly developed turbinates and a very limited sense of smell. The horse has three elaborately scrolled turbinates, manifestly designed for respiration, yet it has also a keen sense of smell.

The replacement of sensory by respiratory epithelium is one of the great responses to functional needs which the nose has undergone in the process of evolution from purely olfactory to a largely respiratory organ. The author thinks that the sinuses exist to give bulk and strength to the framework of the face without adding to its weight. He also feels that they have some further function, as yet unknown. Probably their most important function in man is as resonating chambers in relation to speech.

The Referred Pain of Nasal Sinus Disease. The location of pain in nasal sinus disease may also be that which is felt in distant visceral disease, and in the anemias. J. A. Gibb[5] thinks that although the pain in a particular situation may be such as to be caused by disease of the ear, nose, or throat, it should not be described as pain propter quod unless the sinuses are proved to be diseased and, after appropriate treatment, the pain is relieved or entirely disappears. The author emphasizes that pain is often caused by carious teeth. Removal of the teeth will relieve the severity of the pain, but it will not disappear until the sinus condition is treated.

The author presents the results of 40 of these cases, treated in the past year. The position and severity of the pain do not depend in all cases on the severity of the diseased condition of the sinus. The situation of the pain is constant. The pain in maxillary sinus disease is pareital, occipital, in front of the tragus, in the helix, the concha, or the mastoid process. Pain from frontal sinus infection depends upon whether the duct is partially or entirely closed, and whether the condition is one of empyema or not. The situation of the pain is frontal and occipital.

The pain in ethmoid disease depends upon whether the anterior or posterior cells are affected. If the anterior cells are diseased the pain is in the eyeball and maxillary process, and across the bridge of the nose. If the posterior cells are infected the pain is in the back of the eye and on top of the head. When the sphenoid sinus is affected the pain is similar to that in disease of the posterior ethmoidal cells, but is of a boring character on top of the head.

[While localized pain and headache constitute a common symptom of sinus disease we should remember that many more cases of headache are the result of conditions not related to sinus disease.—Ed.]

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(5) Jour. Laryngol. and Otol., January, 1924.

Accessory Sinusitis—Sources of Diagnostic Error. Within recent years M. M. Pomeranz[6] has examined approximately 300 cases of accessory sinus disease, and during this time has often been impressed with the divergent opinions voiced by medical men concerning the value of radiographic examinations as a routine measure in all cases where such procedures would seem to be indicated.

Radiograph examination of the sinuses in the hands of a skilled radiographer is an invaluable aid in the interpretation of a diseased condition. The author wishes to call attention to some of the common sources of error in the usual cases examined.

Necessity of preliminary examination. A thorough physical examination is as important in this as in any other type of disease. There is a large number of extra-sinus conditions that simulate true sinus disease: errors of refraction, infected teeth, gum abscesses, unerupted teeth, headaches, neuralgias, and indefinite facial pains.

Radiography vs. transillumination. Some otolaryngologists believe roentgenology to be superfluous, but the author thinks that references to the anatomy of various skulls show the dangers of relying solely on this method as a diagnostic method. A true appreciation of the normal as well as variations within the normal, is absolutely imperative in the consideration of any pathology. The frontal sinuses are often absent and when present vary in size, shape and depth, as well as in the thickness of the anterior bony wall. The practical importance of this is great. The author does not contend that transillumination is utterly valueless but does believe that too much reliance is placed on this as a diagnostic means. It is of certain value in the antra, but it is absolutely worthless as a definite guide in frontal sinus disease. On the other hand, the radiographic error in interpretation is often due to an imperfect appreciation of the various

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(6) Med. Jour. and Record, Feb. 6, 1924.

shades of density, which the various pathological sinuses will produce. The author considers several types of cells as an illustration of this point.

1. The small, thick-walled sinus of average depth may well give the appearance of the presence of either pus or granulations, whereas no such pathology may be present, or conversely.

2. The large, deep, thin-walled sinus may give a normal appearance and yet contain granulations or pus.

The reasons for this will be apparent. The small sinus will often, but not invariably, have a thick anterior wall with little air-containing space, the ray will have greater difficulty in penetrating and the result is a radiograph that might be variously interpreted. In the second case cited, the easy penetration of a large, thin-walled, air-containing cavity will often obliterate finer shadows indicative of pathology.

3. In early cases of acute sinusitis, particularly in the small type sinus, the exudate present very often will not add materially to the density of the cells under examination, and with the present limitations of the *x*-ray will not cast an appreciable shadow in the sinus area. This diagnostic error holds for both the *x*-ray and transillumination. It is just this finer appreciation of shades and shadows that materially reduces the percentage of error. Röentgenologists will often have a sort of intuitive knowledge of the amount of density to expect from the various types of cells.

4. A fourth source of röentgenological misinterpretation is fortunately rare—the mistaking of an absent sinus for one that contains granulations or pus. It should be stated in this connection that no matter how much pus there be contained in a frontal sinus, there should remain a limiting cellular border. Its absence means the lack of a frontal sinus and can usually be checked on the lateral view of the skull. This fact is invariable, according to the experience of the writer.

Ethmoidal Sinuses. In re-reading many of the films referred for confirmatory diagnosis, the author has noted a tendency to ignore in the written reports the presence of ethmoidal cells in the frontal region. These cells are commonly infected and when present give symptoms identical with those of true sinus disease. The failure to note such a condition results in unwarrantable delay and annoyance to the physician and to the patient.

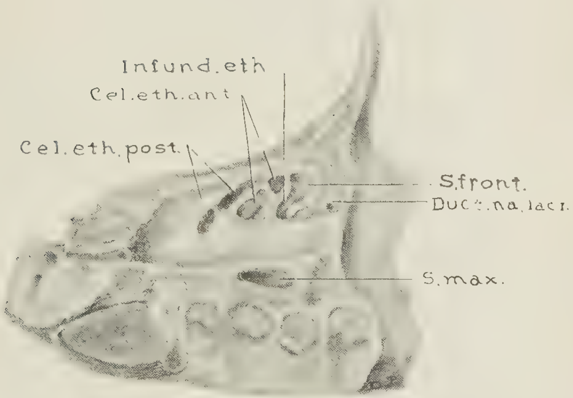
The handicaps usually met with in accessory sinus disease do not as a rule pertain to the ethmoidal sinuses. Here the easy accessibility of the field under scrutiny permits of quick and easy diagnosis. It is to be remembered, however, that those living in large cities have always some degree of ethmoidal infection. It is to be deplored that there is not a more universal use of the *x*-ray considering indefinite causes of eye disease. The information that may be obtained in these cases is often of great importance.

Sphenoidal Sinuses. The sphenoidal sinuses are more commonly involved than is suspected. Here again technical difficulties complicate the diagnosis. The usual view employed is a lateral view of the skull, which superimposes most of the bony structures of the face over the region of the sinuses and, furthermore, gives but at best a lateral view of the area under investigation, making accurate interpretation difficult. The author has adopted the Pfahler technic of demonstrating these cells and has found that it considerably facilitates the diagnosis of sphenoid disease. Briefly, this method consists of a two by three film placed in the mouth between intensifying screens. The exposure is then made through the vertex of the skull. The advantage of this method is that it gives a horizontal projection of the ethmoidal cells and a very distinct picture of whatever pathology exists. This method also affords a means of comparing both the right and left sphenoidal sinuses—so difficult to obtain on other views.

Maxillary Antra. The author appreciates the disappointment of the otolaryngologist in failing to obtain pus on puncturing a röentgenologically positive antrum. A common source of error is due to the position in which the exposure is made. The usual position is a posterio-anterior view with the tube so placed as to project the petrous portion of the temporal bone into the lower half of the orbit, out of the maxillary area. This as a rule permits of easy and reliable interpretation. However, this is sometimes incorrectly or imperfectly done, with the result that a bone shadow of considerable density is thrown over the maxillary area. The writer has in addition to the usual posterio-anterior view added the Walters-Waldron position. In this position, exposure is made through the vertex of the skull, with the chin of the patient placed on the plate. Radiographs taken in this position are of invaluable aid in checking up any pathology demonstrated by the orthodox posterio-anterior view. This is also a view that will check any demonstrated frontal sinus pathology. In this method, the petrous portion of the temporal bone is projected out of the field under examination. Frequently definite diagnosis may be made by this position, where the pathology on the posterio-anterior plate was obscure. The author has had striking results with this technic.

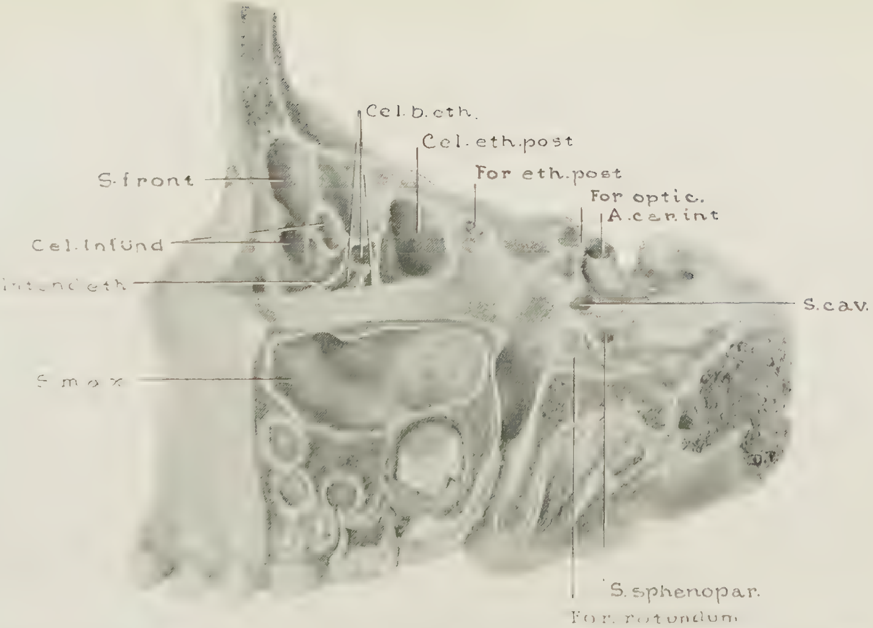
Röntgenologically, it is impossible to differentiate between the presence of either pus or granulations in the antra. Various media have been injected in an attempt to see whether a radiographic difference could be detected but no working formula has as yet been devised. Hence on the radiographic report it is usually stated that pus or granulations may be present and consequently if on puncture no pus is obtained, the fault is not with the radiographer, since the antra might still contain granulations or a markedly thickened membrane. The author has never yet seen a fluid level in the antra. The technic of the exposure calls for the patient to be placed face down; consequently the fluid, if present, will move up

PLATE XXX.



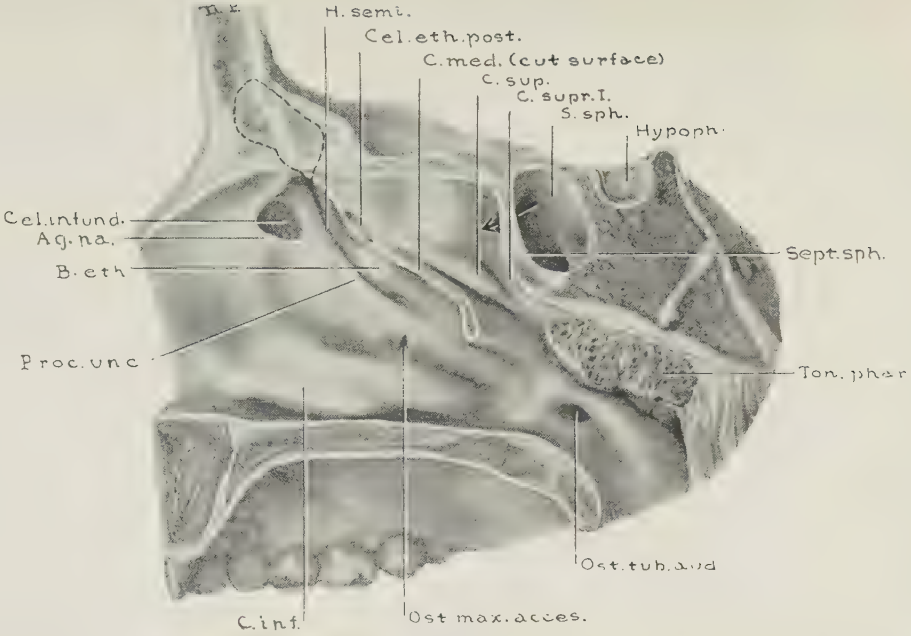
Specimen from a child eight days old. (Series D, No. 1.) By sagittal sections removing the lateral portion of frontal bone, lamina papyracea of ethmoid, and lateral portion of maxilla—the sinus maxillaris, cellulae ethmoidales, anterior and posterior, infundibulum ethmoidale, and the primitive sinus frontalis are brought into view. *S. front.*, primitive sinus frontalis; *Duct. na. lacr.*, ductus nasolacrimalis; *S. max.*, sinus maxillaris; *Cel. eth. post.*, cellulae ethmoidales posterior; *Cel. eth. ant.*, cellulae ethmoidales anterior; *Infund. eth.*, infundibulum ethmoidale.—Davis, page 371.

PLATE XXXI.


Cel. b. eth.
Cel. eth. post
S. front
For eth. post
For optic.
A. car. int
Cel. Infund
Infund. eth
S. cav.
S. max
S. sphenopar.
For. rotundum

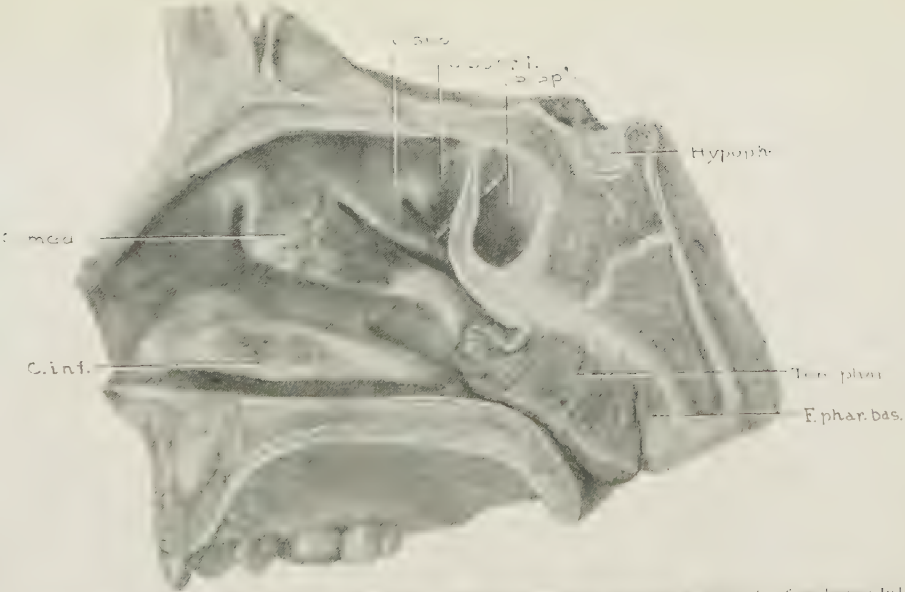
Specimen from a child two years, six months, and twelve days old. (Series D, No. 25.) Lateral view of left frontal, ethmoidal, and maxillary sinus areas. Note advance of sinus frontalis into the vertical portion of the frontal bone. *Cel. b. eth.*, Cellulae bullae ethmoidales; *Cel. eth. post.*, cellula ethmoidalis posterior; *For. eth. post.*, foramen ethmoidale posterius; *For. optic.*, foramen opticum; *A. car. int.*, arteria carotis interna; *S. cav.*, sinus cavernosus; *S. Sphenopar.*, sinus sphenoparietalis; *For. rotundum.*, foramen rotundum; *S. max.*, sinus maxillaris; *Infund. eth.*, infundiculum ethmoidale; *Cel. infund.*, cellulae infundibularis; *S. front.*, sinus frontalis.—Davis, page 371.

PLATE XXXII.


H. semi.
Cel. eth. post.
C. med. (cut surface)
C. sup.
C. supr. I.
S. sph.
Hypoph.
Cel. infund.
Ag. na.
B. eth
Sept. sph.
Proc. unc
Ton. phar
Ost. tub. aud
C. inf.
Ost max. acces.

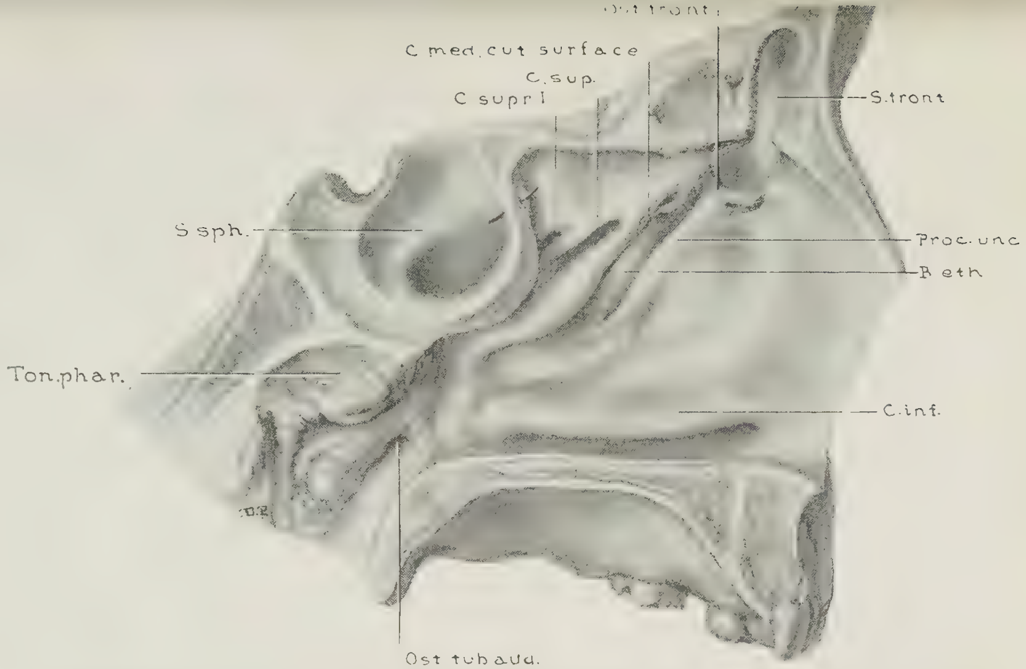
Specimen from a child five years, ten months and twenty-two days old. (Series D, No. 45.) Sagittal section, ¾ mm. to the right of median line anteriorly; section through body of the sphenoid 2 mm. to the right of median line. Anterior portion of concha media has been removed to show the lateral nasal wall. Medial wall of an infundibular cell was removed with the anterior attachment of the concha media. Ostium frontale in this case communicates both with the infundibulum and with the recessus conchalis medial to the processus uncinatus. Dotted line indicates outline of sinus frontalis. *H. semi.*, hiatus semilunaris; *Cel. eth. post.*, cellula ethmoidalis posterior, extending into concha media; *C. med.*, concha media (cut surface); *C. sup.*, concha superior; *C. supr. I.*, concha suprema I; *S. Sph.*, sinus spenoidalis; *Hypoph.*, hypophysis; *Sept. sph.*, septum sphenoidale (anterior portion); *Ton. phar.*, tonsilli pharyngea; *Ost. tub. aud.*, ostium pharyngeum tubae auditivae; *Ost. max. access.*, ostium maxillare accessorium; *C. inf.*, concha inferior; *Proc. unc.*, processus uncinatus; *B. eth.*, bulla ethmoidalis, *Agna.*, agger nasi; *Cel. infund.*, cellula infundibularis.—Davis, page 371.

PLATE XXXIII.



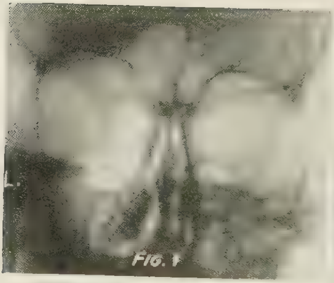
Specimen from a child of six years old. Sagittal section showing extent of sphenoidal pneumatization. (Series D, No. 46.) The child from whom this specimen was taken died of nasal diphtheria. Note areas of submucous hemorrhages. The nasal cavities were completely filled with pseudomembrane, as were also the frontal sinuses and ethmoidal cells, while the maxillary and sphenoidal sinuses were approximately half filled. Also note the enormous tonsilla pharyngea, which nearly fills the posterior naris. *C. sup.*, concha superior; *C. sup. I*, concha suprema I; *S. sph.*, sinus sphenoidalis; *Hypoph.*, hypophysis; *Ton. phar.*, tonsilla pharyngea; *F. phar. bas.*, fascia pharyngobasilaris; *C. inf.*, concha inferior; *C. med.*, concha media.—Davis, page 371.

PLATE XXXIV.


Ost front.
C med. cut surface
C. sup.
C supr I
S. front
S sph.
Proc. unc
B eth
Ton. phar.
C. inf.
D.Z.
Ost tub aud.

Specimen from a child ten years, one month and seven days old. (Series D, No. 66.) Sagittal section 1 mm. to the left of the median line. The anterior portion of the concha media and a portion of the medial wall of the sinus frontalis have been removed. Note that sphenoidal pneumatization has extended beneath the anterior portion of the sella turcica. *S. front.*, sinus frontalis; *Proc. unc.*, processus uncinatus; *B. eth.*, bulla ethmoidalis; *C. inf.*, concha inferior; *Ost. tub. aud.*, ostium pharyngeum tubae auditivae; *Ton phar.*, tonsilla pharyngea; *S. sph.*, sinus sphenoidalis; *C. supr. I*, concha suprema I; *C. sup.*, concha superior; *C. med.*, concha media; *Ost. front.*, ostium frontale.—Davis, page 371.

PLATE XXXV.



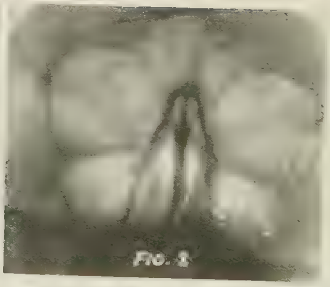
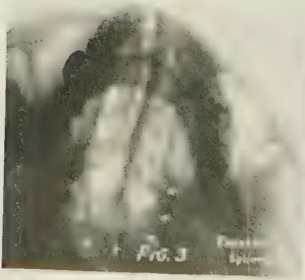


Fig. 1—Frontal-ethmoid: (23°) projection, postero-anterior; frontal asymmetrical, both clear; ethmoids, left clear, right diseased (note unsatisfactory shadows of antra).

Fig. 2—Maxillary projection: postero-anterior (Water's position). Left clear, right has rounded tumor, probably polyp or mucocele (not visualized on 23° projection). Frontal shadows confirmed.



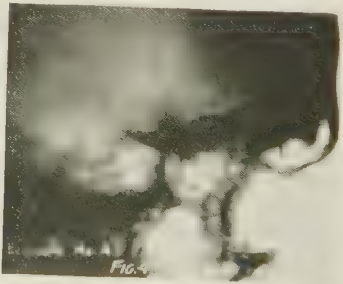


Fig. 3—Vertical sphenoid projection: superior inferior, showing clear sphenoid cells, fairly symmetrical outline and extent (not seen on 23° projection).

Fig. 4—Lateral projection revealing topography of all sinuses, particularly the frontal and sphenoid areas. Blaine, page 378.

and homogeneously overshadow the antra. This is noted in lung work, where the chest will be homogeneously clouded if the patient is placed flat on his chest and the exposure is made. In the upright position, a typical fluid level may be demonstrated in the presence of air in the pleural sac.

It is perfectly possible to conceive a condition where a trochar and cannula introduced into a pus containing antrum may still fail to demonstrate pus, since the level of the floor of the antrum is more often below the level of the floor of the nasal cavity. Here the level of the fluid may be below the level of the exploring instrument and no fluid be obtained as a result. Often the viscosity of the fluid is such that it is too thick to flow readily through the needle. Repeated irrigations will often demonstrate pathology not found at the first examination.

[A satisfactory diagnosis of sinus conditions often requires the assistance of the skiagraph. On the other hand other methods of examination, intranasal and transilluminate, will very often render the resort to the skiagraph quite unnecessary. The proper method of examination is to begin with intranasal inspection followed by transillumination. When these leave any doubt and when any symptoms suggest a possible sinusitis the skiagraph should be made.

We do not understand the author's statement that puncturing of the antrum can fail to discover pus because the needle projects above the level of the pus. The puncture is made for the purpose of irrigation and it does not matter whether the point of the trocar is above the level of pus in a partially filled antrum.—Ed.]

Paroxysmal Cough, A Frequent Symptom of Infection of the Para-Nasal Sinuses in Children. C. G. Coakley[7] states that he has frequently noted that by treating

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(7) Southern Med. Jour., January, 1924.

para-nasal sinus disease he was able to relieve or cure a troublesome paroxysmal cough which had defied the usual sedative cough mixtures.

The difficulties attending the examination of the paranasal sinuses in children have caused many physicians to overlook this condition. The author emphasizes the variations in the anatomy of the sinuses, and in their development.

The practical importance of this variation in development is the course of the disease once these sinuses of children become affected. The author is convinced that the mucous membrane of the sinuses of children is as often involved consequent to acute inflammations of the nasal mucosa, *e. g.*, colds in the head, as it is in adults. When the cavities are small the sinuses usually evacuate themselves, as soon as the edema and swelling of the nasal mucosa subsides. If the cavities are large and early developed, they may need assistance for recovery either directed to establishing a more free nasal respiration or actual removal of the secretion by irrigation as in adults. The author is also of the opinion that the presence of a mass of adenoids with its attendant nasal obstruction and frequent colds is accompanied by an involvement of the paranasal sinuses much more frequently than has been supposed. The excision of the adenoids by restoring nasal breathing lessens the inflammation of the mucous membrane of the nose and sinuses and permits the sinuses to develop in a more normal manner.

In the diagnosis of para-nasal sinus disease in children considerable reliance is placed on the radiographs, provided they are good.

Transillumination is much less helpful in children than in adults, and yet when one knows the degree of development of these cavities it may be exceedingly helpful. A record or recollection of the degree of illumination during infection may be helpful in indicating progress toward recovery if the illumination improves, or vice versa.

The author has found the use of the naso-pharyngoscope, by which one may more readily see the secretion coming from the neighborhood of the ostia, of very great help, especially in the case of the sphenoid.

The diagnosis of infection of a sinus having been made, the treatment varies with the age. In children under seven nearly all cases will get well by daily contracting the nasal mucosa with 0.5 per cent. solution of cocain and syringing the nares with normal saline at a temperature of 110° F.

In older children with large sinuses, if this does not succeed, the cavities individually must be treated in the same way that one would the corresponding sinus of an adult.

Study of Sinusitis in Children. A survey of the problems in sinusitis in children was attempted by J. M. Lore[8] at the Manhattan Eye, Ear and Throat Hospital. Particular attention was paid to the study of those cases in which patients do not get well after a tonsil and adenoid operation. The investigation led to recommending the following steps in the treatment of these stubborn cases: (1) Tonsil and adenoid operation when first attempt was unsuccessful; (2) correction of diet where indicated; (3) the use of cod-liver oil in all cases; (4) nasal hygiene by means of suction-irrigation, argyrol, lubricants, etc.; (5) antral lavage when indicated; (6) correction of deflected septums when drainage is interfered with; (7) uncapping of ethmoids and sphenoids only in severe cases in which other forms of treatment have not helped.

Sinusitis in Infancy and Childhood. The anatomic studies of W. B. Davis[9] show that pneumatization of the lateral ethmoidal mass proper is usually complete at birth. The cells subsequently increase in size by expansion as the ethmoidal area grows, and also by invasion of the surrounding areas. Frontal sinuses are not present at birth, but have their origin in all cases

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(8) Laryngoscope, December, 1923.
(9) Therap. Gaz., Jan. 15, 1924.

from the anterior ethmoidal areas—the relative rate of development of the cells of the different groups of anterior ethmoidal cells determining which will eventually become the frontal sinus. The process of pneumatization gradually extends toward and into the inferior portion of the frontal bone. In an average case the sinus begins its ascent into the vertical portion of the frontal bone during the second year and at 3 years is 3.8 mm. above the level of the nasion. It continues its advance upward at an average rate of about 1.5 mm. per year until the fifteenth year. (Plates XXX, XXXI.)

The maxillary sinus at birth is on an average of 8.2 mm. deep, 3.3 mm. high, and 2.8 mm. wide. It increases 2 mm. in width and height per year up to 9 years. and 3 mm. in depth per year. At the fifteenth year it approximates the usual adult type. The average relation of the floor of the maxillary sinus to the nasal floor is of clinical importance in determining the point for making punctures of the medial wall. In children under one year the level of the average sinus is 4.2 mm. superior to the floor of the nasal fossa. At the eighth or ninth year the floors are at the same level, and in children older than this the maxillary sinus floor is from 1 to 7.5 mm. below the nasal floor.

The sphenoidal sinus develops more rapidly posterolaterally than it does directly posterior. In the average case the rate of resorption of the body of the sphenoid is such that by the eighth to the tenth year the posterosuperior portion of the sinus lies beneath the anterior portion of the sella turcica. (Plates XXXII, XXXIII, XXXIV.)

The most frequent causes of infection of the accessory sinuses in early childhood are colds, influenza, acute exanthematous diseases, and pneumonia. The conditions are far more apt to develop in children with infected tonsils and enlarged adenoids. A deflected septum or enlarged middle turbinate may be a predisposing factor even in early childhood. The order of frequency of location in which infections occur in the sinuses in children is, in descending order, ethmoidal, maxillary, sphenoidal, and frontal. The diagnosis is based largely on the character of the nasal obstruction and discharge, on the results of transillumination, and on the *x*-ray plates. For final diagnosis in maxillary sinus disease, and before an exploratory puncture is made, an *x*-ray should be taken.

In the great majority of cases treatment should be conservative. Mildly astringent oil applications and argyrol favor ventilation and drainage. Mixed vaccines may be of benefit. When infected tonsils and enlarged adenoids are present in subacute and chronic cases, they should be removed and nasal treatment continued. While most cases respond to treatment, the destruction of surrounding bony tissue may be surprisingly rapid in some infections occurring in the ethmoidal and maxillary sinuses. The author reports two cases illustrating this possibility. The results in each case were fatal.

Treatment of Para-Nasal Sinus Disease in Infants and Young Children. Change of climate has a very great bearing upon the prognosis in chronic para-nasal sinus disease. L. W. Dean[1] states that patients who do not respond to treatment in Iowa improve as if by magic in Arizona. Next in importance in the treatment of this condition in infants and children, is diet. It has been found in the Department of Pediatrics at the University of Iowa that animals fed diets very low in the so-called fat soluble vitamine (vitamine A) are subject to para-nasal sinus infections. The addition of substances rich in vitamine A corrects the condition if dietary therapeutics are inaugurated sufficiently early. It is questionable whether or not the para-nasal infections in children are infections superimposed on an undernourished condition, the result of diets low in the fat soluble vitamine. It is significant, however, that in the author's ward, mastoiditis developed only in those infants receiving feeding formulas low in fat.

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(1) Laryngoscope, January, 1924.

When a child has a para-nasal infection, diet alone cannot correct the condition. The source of infection must be removed first, and then proper dietary regimen instituted. The diet, except for babies, should contain a fairly liberal amount of butter, vegetables, fruits, milk, eggs and cereal foods. In so far as possible all fat should be supplied in the form of butter or cream. Cod liver oil may also be given once or twice a day. It is essential to see that the diet prescribed is taken. The author emphasizes the fact that he does not wish to give the impression that the absence of the fat soluble vitamine A is the cause of para-nasal sinus infection, but that errors in diet play a most important part in this class of cases. The correction of the diet has brought about a most remarkable improvement in the infants and young children in the author's ward. These patients had had everything possible done for them from a rhinological standpoint, and with no results.

In addition to climate and diet, proper hygienic conditions are important. Rest in bed, ventilation of the room and sunlight are essential. A hot nasal irrigation, followed by dropping some antiseptic, as argyrol, into the nose, should be included in the treatment. Diseased tonsils and adenoids, if present, must be removed in every case of chronic nasal sinusitis.

It is best to place the patients in a hospital, and study them daily, trying one kind of treatment and then another. A radical operation is performed only when some serious secondary systemic or local condition can not be relieved unless the sinus trouble be wholly eradicated.

[This is an excellent review of contributions on sinus disease in children. Acute sinusitis in childhood occurs much as it does in adults. The chronic forms are much less common. In making the diagonsis more reliance must be laid on the skiagraph. The treatment is along conservative lines; general hygiene, dietetic, climatic, and the resort to local measures such as is outlined by Coakley. The necessity for surgical measures and the resort to antrum irrigation is only rarely indicated.—Ed.]

Conservative Treatment of Maxillary Sinus Disease. Maxillary sinus disease is classified by J. D. Fouts[2] into acute, subacute and chronic, and the latter again into those without necrosis or polypoid degeneration, those with degeneration, and those of malignancy. In cases of acute sinus infection the most important thing is a very careful history, and secondly, the objective findings in the nose on examination. Transillumination and *x*-ray furnish further information. *X*-ray plates should be taken stereoscopically, as single plates are misleading. Every otolaryngologist should be able to interpret his own *x*-ray plates and not need to have the radiologist interpret them for him. There need be no hesitation at any time to make a puncture of the sinus when there is doubt as this procedure is the nearest positive method of proving or disproving our suspicions. Care, of course, must be used as the puncture is not without danger. Irrigation through the natural opening, advised by some, does not seem satisfactory.

When the diagnosis of acute sinus infection has been made, the nose should be shrunken with cocain and adrenalin, and if necessary, the middle turbinate fractured as far to middle line as possible to prevent encroachment on the natural openings. If the case be a simple acute inflammation there are usually signs of improvement within a few days. Should the antrum be punctured and found to contain only serum, irrigation should not be continued, but shrinkage and suction used. When pus is present, daily irrigations of normal saline solution is advised. There is no harm done and no time lost by delaying irrigation several days during the acute stage of a suppurative sinus. When done immediately the discomfort to the patient is much greater. The irrigations are reduced in proportion as the return solution tends

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(2) Ohio State Med. Jour., October, 1923.

to become clear. When no improvement is seen in two weeks the opening under the inferior turbinate is enlarged by means of a rasp. In the subacute type there is usually a history of repeated colds for several months. The inferior turbinate shows turgesence, and pus may or may not be present. The *x*-ray and transillumination are usually positive. Suction is unsatisfactory and daily irrigation should be started immediately. The number and frequency of the irrigations and the enlargement of the opening depend upon the course of the particular case. Many are cleared up in a week or two.

The cases of chronic sinus disease have usually extended over a period of months or even years. Nasal examination may be practically negative. *X*-ray and transillumination may or may not be positive. On insertion of the trocar in cases without degenerative changes much force is usually required and little or no bleeding occurs. If, on the other hand, considerable bleeding is encountered and the trocar is easily forced through, there are usually degenerative changes present. For the non-degenerative type, or in cases where one is in doubt, the irrigation method is best. Should this fail, window resection under the inferior turbinate should be done. These cases usually require irrigation over a considerable period of time. When a positive diagnosis has been made of polypoid degeneration or bone necrosis there is little doubt but that radical treatment is necessary. The operation of choice is the Caldwell-Luc.

Cases of malignancy are fortunately rare in the practice of the average man. Radium and surgery, used together or separately, usually produce the same end result. Radium tends to prolong life and as a rule makes easier the end result.

[The acute and subacute antrum infections respond readily to simple irrigation. The exceptions are very unusual. Most cases of chronic antrum disease recover spontaneously after a window resection of the nasal wall, made either below or above the inferior turbinal body. The more radical operations are only exceptionally required.—Ed.]

Negative Pressure in the Treatment of the Diseases of the Nose and the Accessory Sinuses. G. C. Otrich[3] calls attention to the histologic function of the nasal mucous membrane. In acute stages of infection there is a hyper-congestion and the ostia of the various sinuses become partially or completely blocked. The normally contaminated air in the cells easily becomes an incubator. Thus occur congestion, beginning destruction and disappearance of the ciliated cells, the appearance of pavement epithelium, and the growth of fibrous tissue choking off and obliterating the arterioles and veinlets.

The several suction apparatuses or methods that may be used, the ultimate results being the same, are: Lori suction tips (suction and irrigation); Smith's sinus syringe, and Coffin's apparatus. No medication is necessary in conjunction with the negative pressure.

Negative pressure assists nature by re-establishing the circulation to the affected parts, and so helps in the arresting of the offending organism.

In cases where suppuration and necrosis have taken place, and surgical measures must be resorted to, we know that there is a very low resistive condition present, due to the strangulation of the small vessels by fibrous tissue and the destruction following the operation.

By applying negative pressure as soon as possible after the operation, without causing hemorrhage, but not waiting for a complete cicatrization of the part, there will be a very rapid disappearance of the pus. The area will heal without the dry crust formation. This is due to the establishing of a collateral peripheral circulation and an increased secretion from the glandular structure.

One of the most discouraging conditions we have to deal with is atrophic rhinitis in almost all its forms. We

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(3) Illinois Med. Jour., January, 1924.

know that the whole process is one of diffuse sclerosis, in which the ciliated epithelium is replaced by stratified epithelium.

In the treatment of these cases, the author has tried almost everything, but his best results have been with negative pressure. Suction is applied to the greatest degree that the patient can stand and until several grams of a bloody serum have been collected.

The Routine X-ray Examination of the Nasal Sinuses by Four Projections. The usual technic in *x*-ray examination consists of two exposures, one of which is a postero-anterior projection, and the other is a lateral view. According to E. S. Blaine[5] the postero-anterior, 23° projection, is of greatest value for the frontal sinuses but of less value for the sphenoid, ethmoid and maxillary sinuses. The author believes that for satisfactory examination of the sinuses the following four projections are necessary: the 23°, postero-anterior; the maxillary, postero-anterior; the sphenoid, superior-inferior; and the lateral.

The author discusses the technic and advantages of each of the four projections in detail and presents a number of roentgen figures. (Plate XXXV.)

Conservation in Ethmoid Surgery. All surgical approach to the nose should take into consideration the important physiological functions of the nasal mucosa, which warms, filters, and moistens the inspired air. Besides, the end organs of olfaction are present in the upper part of the nose. E. McGinnis[6] calls attention to the fact that the removal of any considerable portion of the nasal tissue upsets its function, and this upsetting is part of the reason for the dissatisfaction of some of our operated cases. A good many cases are seen of complete ethmoid exenteration with ablation of the middle turbinate and surgically they do not satisfy one's esthetic

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(5) Jour. Radiol., September, 1923.

(6) Jour. Indiana State Med. Ass'n., November, 1923.

sense. Practically they are cured of the ethmoid infection because the ethmoid is removed, but this sacrifice of tissue has removed good part of the olfactory membrane, and converted a slit into a wide open space. The author's operation is preceded in most cases by a preliminary high nasal septum resection.

Adrenalin 1:1,000 on a cotton swab is applied to the anterior end of the middle concha, and as high above this as possible, and lastly, application to the septal mucosa opposite. After shrinkage is complete, one more application of adrenalin is made on each side of the concha and to the ethmoid bulla. Two applications of 20 per cent. cocain are made to the surfaces mentioned above. With the patient's head in extreme extension, the mound of an agger cell, if one is present, is opened into with Grunwald's forceps. When the agger cell is absent, the front of the ethmoid labyrinth above the attachment of the middle turbinate is opened. If there is one or more agger cells, part of the inferior, superior and posterior walls are cut away, and above these some of the front wall of the naso-frontal duct. The free border of the turbinate is pushed toward the septum and the front of the lower cell of the ethmoid bulla is opened up to the frontal ostium. This opens all the anterior cells and one posterior cell. If it is necessary to drain the remaining posterior cells a channel is made through the posterior and upper wall of the bulla into the large posterior cells. In the procedure outlined all the ethmoid cells are opened, the normal ostia of most of them are undisturbed, the middle turbinate and turbinal plate are intact, and most of the cell lining is in place. Little hemorrhage is encountered, the incisions remain open as long as there is need for drainage, and in case of reinfection the cells can again be opened. Recovery is usually rapid, and no after treatment is needed. The author has had two cases with eye complications, one hemorrhage into lower lid at time of operation, and one hemorrhage into the orbit one hour after operation. Practice on the cadaver before attempting the operation on patients is strongly advised.

The Frequency of Sphenoidal Sinus Operations. G. S. Fraser* calls attention to the great and increasing frequency with which the sphenoidal sinus is operated on. Naked eye examination of paranasal sinuses at autopsy would lead to the conclusion that 33 per cent. of subjects have suppurative or catarrhal affections of these cavities.

The author examined the sphenoids in 50 consecutive cases at autopsy; 27 of the 100 sinuses inspected showed abnormal contents. Such inspection, however, is fallacious because the sphenoid sinus may contain stomach contents, or mucus which has accumulated from the nose or nasopharynx because of diminished ciliary action and absence of normal means of removal. Clinical experience supports the view that inflammation of the sphenoid sinus is less common than similar affections in the other sinuses.

In 19 years the author has performed 900 operations on the mastoid, 300 on the maxillary sinus, 50 on the frontal sinus, but only 17 on the sphenoid. He points out that all headaches are not due to sphenoidal sinus suppuration. Roentgenograms are not always reliable. He considers that retrobulbar neuritis may be compared to nerve deafness and giddiness, which are usually due to toxemia from various causes, and not to middle ear suppuration and mastoiditis. The causation of mastoid and intracranial complications of middle ear suppurations corresponds to the orbital and intracranial complications of frontal, ethmoidal and sphenoidal sinus suppuration, while the causation of retrobulbar neuritis corresponds to that of nerve deafness or Ménière's symptom complex.

(*) Jour. Laryngol. and Otol., Edinburgh, July, 1924.

The author is willing to open the sphenoid if he is told to do so by the ophthalmologist, but his view is that sphenoidal sinusitis is a rare affection.

Hay Fever and Asthma

Details in the Treatment of Hay-Fever, Asthma and Other Manifestations of Allergy. The development in our knowledge of the subject of hypersensitiveness, its diagnosis and treatment, marks an important advance in the theory and practice of medicine. According to W. W. Duke,[8] illness caused by hypersensitiveness to foreign substances can be treated along five different lines, namely, avoidance or removal of the specific cause of the illness; avoidance or removal of contributory causes; specific protein treatment; non-specific protein treatment; and symptomatic treatment. In the majority of cases, two or more of these measures can be used to advantage.

The simplest method is best, when it can be used, namely, avoidance or removal of the specific cause of illness. In these cases it is important to know whether the symptoms occur as a result of direct contact with the substance and the air passages or as a part of a general reaction, such as follows indigestion of certain foods. It is furthermore important to know whether an individual is sensitive to a given substance in its natural state only, or whether he is also sensitive to the substance after it has been cooked.

The substances mentioned which may be avoided or removed are the pollens, oris root, essential oils, coal and oil products such as benzol and gasoline; food such as milk, eggs, wheat, vegetables and fruits; drugs, animal dander, house dust and smoke. Bacterial causes may

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(8) Amer. Jour. Med. Sc., November, 1923.

sometimes be removed by removal of foci of infection. Removal of contributory causes is considered only when one fails in his effort to find or remove the specific cause. Factors are mentioned such as the removal of irritating agents to the skin, foods which mechanically irritate the intestinal canal, avoidance of condiments. Correction of any pathology which might give rise to pathological reflexes, and treating if possible any dysfunction in the glands of internal secretion. A serious careful effort in this line often gives relief which can be obtained in no other way.

The author discusses the pollen treatment under specific protein therapy. Several plans were tried, but the most satisfactory one included also the local applications of pollen solution to the nasal mucous membrane. The injections begin with a dose of 0.1 c.c. of a solution containing 0.001 mg. of pollen to the cubic centimeter and each day the amount is doubled, 0.2 c.c. on the second day, 0.4 c.c. on the third, and 0.8 c.c. on the fourth day. On the fifth day 0.1 c.c. of a solution containing 0.01 mg. of pollen to each cubic centimeter is used. This increase in dosage and concentration is continued until a dose of 0.25 c.c. to 0.5 c.c. of a solution containing 10 mgs. of pollen for each cubic centimeter is reached.

The treatment is commenced, when possible, in June, and where the maximum dose is reached before the onset of the season this dosage is spaced from three to six days, and is repeated until that time and then stopped. When there is need for haste the injections are given twice daily. It is believed that giving the injections daily gives less risk of reaction than when several days intervene. Patients who stop therapy for two weeks or more are likely to react strongly when treatment is resumed unless the dose is reduced. This plan must be varied in more than 50 per cent. of the cases.

When an injection produces a local reaction which does not subside in 24 hours the following injection must be postponed until this is over and then the previous injection repeated, or even a smaller dose given.

When no alarming reaction is encountered, the patients are not allowed to leave the office for a half to one hour after receiving the injections. If they complain of itching or redness of the skin, swelling of the tongue, oppression in the chest, cough or wheezing or pain in the back, 0.5 c.c. of adrenalin (1:1000 solution) subcutaneously is given immediately, and repeated every three or four minutes until improvement is shown. Atropine 1/100 grain subcutaneously is often valuable. These two drugs are usually very effective. In addition to their emergency value they may be used temporarily as useful symptomatic remedies, while the more lasting methods of treatment are being instituted. The adrenalin is given at five or ten minute intervals as is indicated, and the atropine either subcutaneously or by mouth two or three times a day.

Local treatment is given to those who develop hay-fever in spite of the injections, or who seem to be less than 75 per cent. relieved, or who were late in starting the injections. A mixture of several 1 per cent. suspensions of the more important pollens of the district are sprayed at daily intervals into each eye and nostril. After a few days the reactions usually subside and after ten treatments most of the patients are partly or totally relieved of hay-fever. In addition to this treatment the patients are instructed to keep the windows closed and to remain quietly indoors as much as possible. When needed, a lotion of adrenalin (1:1000 solution) 1 c.c. and resorcin solution (3 per cent.) 31 c.c. is applied to conjunctiva and mucous membrane.

Of the 63 patients treated as outlined, only 10 per cent. failed to get marked relief. The percentage of patients relieved hardly reaches 50 per cent. if treatment is inadequately administered. Patients seem to be divided into two classes, those who are easily relieved, and the others who are relieved with difficulty. It is impossible to surmise in advance to which class a patient belongs. Specific therapy with proteins other than pollen has not been successful in the author's experience. In the non-specific protein treatment colon bacillus subcutaneously or intravenously, has been found beneficial, although the relief rarely lasts longer than two to six months. It is only recommended in general allergy if the more logical methods cannot be used, or if these fail.

In conclusion, it may be stated that the avoidance or removal of the specific cause is the method of choice. Where this is not possible, specific protein treatment is advised if the specific cause is known. Should this not be known, non-specific protein treatment is worthy of trial.

[It is with no little relief that the rhinologist welcomes the assistance from the internist in solving the problem of hay-fever and allied conditions. Although the nasal symptoms are often the most striking, the problems of treatment are those which the internist should be best able to handle.

The co-operation of the internist with the rhinologist is essential in the proper handling of more than one of our daily problems.—Ed.]

Influence of Ultraviolet Irradiation on Calcium Content of Blood Serum. After a careful review of the literature, F. J. Novak, Jr., and A. R. Hollender[9] find no information regarding the relationship, if any, between hay-fever and hyperesthetic rhinitis, and an ionic calcium deficiency of the human blood serum. The ionic calcium is found in the exuded serum of the coagulated blood. Groves and Vines accept the figure of 10.5 mg. of calcium per cent. for the normal calcium content. The present report represents a series of cases met in office and clinical practice, and includes the complaints of the conditions commonly known as hyperesthetic rhinitis, hay-fever and certain types of bronchial asthma.

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[9] Jour. Amer. Med. Ass'n., Dec. 15, 1923.

In the investigation the ionic calcium content of the blood, serum was measured in each patient. While the calcium content was invariably low in hyperesthetic rhinitis, it was not always so in all cases of hay-fever and asthma. The treatment given consisted of calcium lactate, 5 grains and thyroid extract, one-fourth grain, three times daily. Later this was reduced to twice and even once a day. The administration of either drug alone proved unsatisfactory as compared with the combined therapy.

It was found that the benefits derived from this treatment are not permanent unless the medication is continued. The reports of F. Tisdall, and others, show definite improvement in rachitic cases treated by the ultraviolet ray. Accordingly, those patients who had had a recurrence of symptoms when the calcium-thyroid treatment was discontinued, were exposed to the rays of the mercury vapor quartz lamp, of the Victor air cooled type.

The lamp is raised about 1 meter from the patient and fractional body exposures are made, two or three times a week or oftener. The time of exposure, at first two minutes, is increased each time by two to three minutes and the distance of the lamp decreased by three inches. The results obtained are given in the accompanying table. Relief occurred in all cases of hyperesthetic rhinitis, and in some cases of hay-fever and asthma. The ultraviolet ray appears to permanently fix the ionic

	Number of Cases	Average calcium finding	Afforded relief by calcium-thyroid	Cases which appear to be influenced permanently by ultraviolet light
Hyperesthetic rhinitis.	39	8.1	39	39
Hay-Fever...........	36	10.3	16	16
Bronchial asthma.....	12	9.4	6	6

calcium content raised by the combined calcium-thyroid treatment. No other treatment was carried on while this therapy was being continued.

Recognition of the Specific Hay-Fever Pollens. According to F. L. Long[2] it is surprising the ease with which pollen grains can be studied under the microscope. Instead of the tedious routine of making cultures and smears as needed for the study of pathogenic bacteria, a mount of pollen grains can be made by shaking the blooming flowers or scraping the anthers above a drop of water on a slide. The mount is ready to be examined under the microscope as soon the the cover glass is applied.

Pollen grains may be spherical, oval, triangular, etc., in form, and the surfaces are sometimes smooth, but more often covered with striations, pits, markings of various intricate design or covered with spiny projections. Because of these differences in appearance, it is fairly easy to distinguish the pollen grains of many of the plants causing hay-fever. In the case of closely related species or the varieties where the pollen grains are very similar, the positive identification can only be made when the source of the pollen has been found and the plant itself identified.

It is important to find out, each year, what plant species are coming into bloom when the hay-fever cases begin. If physicians would make records of the period of pollen production of these offending plants, sufficient data would soon accumulate so that for any community the probable date for the beginning and ending of the various types of hay-fever would be known and the time for preseasonal treatment could be regulated accordingly. Weather conditions affect the period of pollen production so that there will be some variations each year.

A local diagnosis, in which all the hay-fever producing plants within a range of one or two blocks of the

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(2) Nebraska State Med. Jour., April, 1924.

patient's home are charted, accompanied by the use of pollen plates in the patient's room at night, gives definite information as to the cause of the trouble and the particular pollen treatment required.

The necessity for the use of a home survey is well illustrated by the case of a patient who had always resided in Colorado Springs, but failed to react to the pollen extracts of 29 plants species occurring there which might have caused hay-fever. Another case was that of a physician himself, who was tested with 36 extracts, all of which gave negative reactions. Later a botanist was called in consultation and found chenopodium album, lamb's quarter, growing in the yard and around his home. The patient reacted to the extract of this pollen and as a result of preseasonal treatment he has been practically free from trouble for the past two years.

The futility of the diagnostic methods which have been in common use is shown by the following case. A patient from the Middle West who had been a hay-fever sufferer for many years went to a well known specialist in the East for diagnosis. The physician asked no questions as to what part of the country she came from, or the history of her earlier attacks. He proceeded, however, to test her with the 30 pollen extracts at hand and found that she gave no reaction to any of them. When she returned to her western home, local diagnosis showed the plant to be the common sage of that region.

The particular pollens which are in the air of the patient's bedroom and which he has probably been inhaling, may be accurately determined by the pollen plate method. A glass slide or Petri dish is smeared with any moist, sticky material, as soft gelatine, vaseline, glycerin, etc., and this plate exposed in the patient's room at night at the onset of the hay-fever trouble. If the slide is examined under the microscope the next day, several kinds of pollen grains will probably be found collected on the slide. By comparison with the size and form of the pollen grains on the plants around the patient's home, the plant or plants which are most likely to be causing the trouble will be recognized. If the pollen grains are allowed to remain on the slide longer than over-night, they are apt to germinate or by absorption of moisture become distorted and then cannot be identified. Thus, instead of trying out the patient's sensitivity to a long series of pollens to which he is never exposed, the list required will be narrowed down to one or two selected by these methods.

Airplane Tests of Hay-Fever Pollen Density in the Upper Air. In the application of general preventive measures against hay-fever, it is important to ascertain the distance to which pollen may be carried by the wind in sufficient numbers to produce hay-fever. An important factor in determining this potential area, according to W. Scheppegrell,[3] is the altitude at which these pollens may be found in the air.

In order to establish a scientific basis for determining the convection of hay-fever pollens, it was found necessary to ascertain the altitude at which they are found in the air. The pollen plates exposed on the tower of a bank building in New Orleans (400 feet) demonstrated that the number of pollens at this height equaled those found on the earth's surface. Pollen plates exposed on the summit of Mount Hope in Orleans Park also showed pollens in numbers differing but little from those exposed at Laurelia Villa, 1,000 feet below this level. It was therefore decided to employ some means by which the pollen plates could be exposed to the limit in altitude of pollen infestation.

Airplane Tests. In the selection of the most practical method of exposing plates at different altitudes, the airplane was given the preference, as it has many advan-

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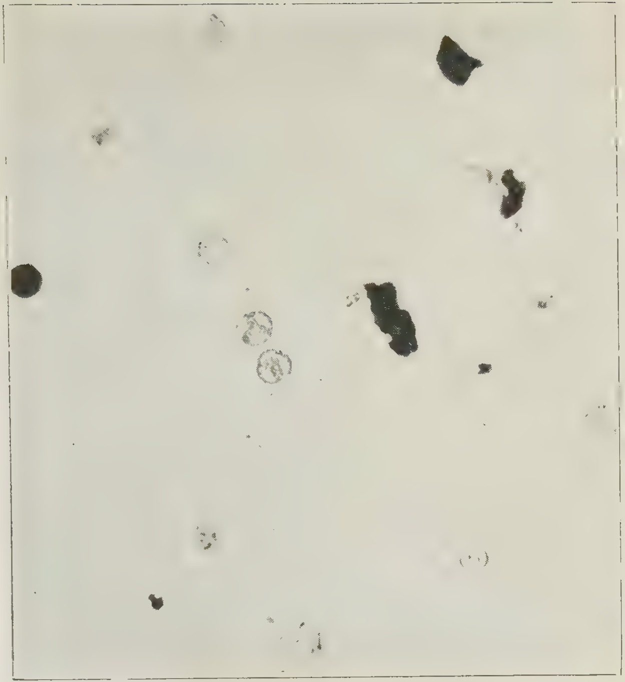
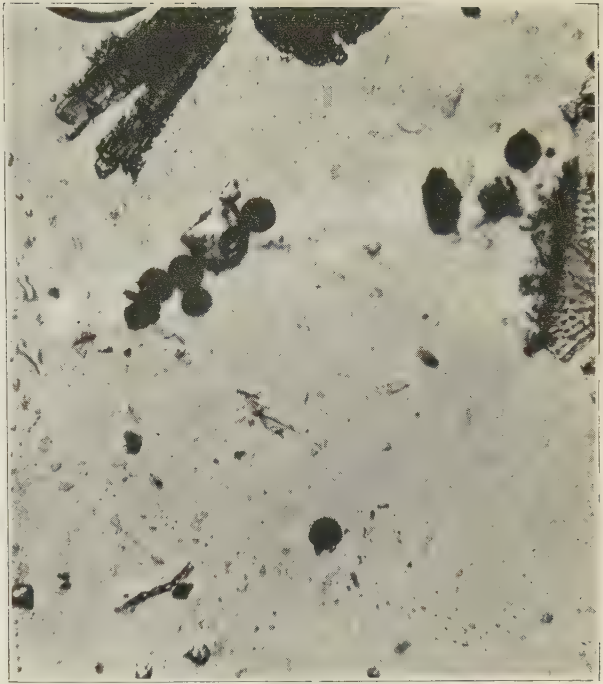
(3) Med. Jour. and Record, Feb. 20, 1924.

PLATE XXXVI.

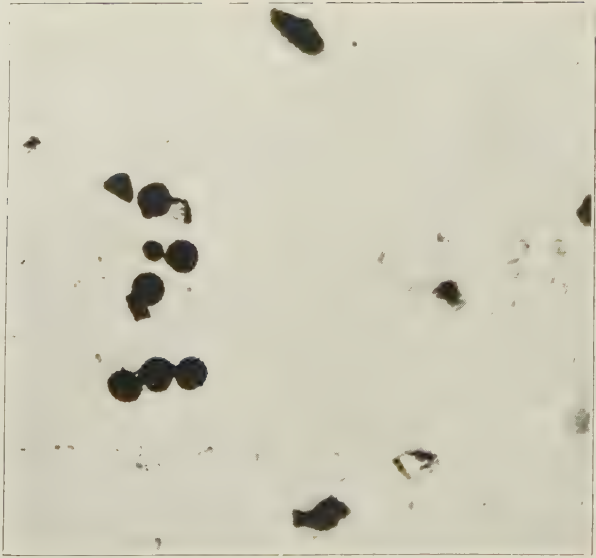


Photomicrograph of pollen plate exposed at 2,000 feet elevation, showing ragweed and grass pollen. x 200 diameters.—Sheppegrell, page 388.

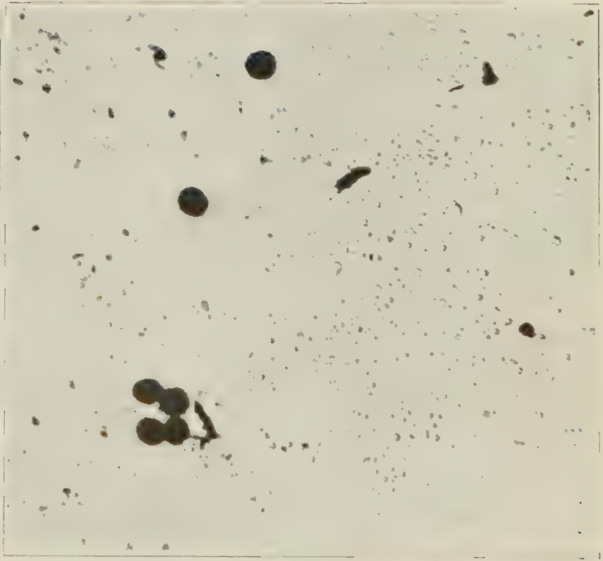


Photomicrograph of pollen plate exposed at 3,000 feet elevation, showing ragweed and marsh elder pollen. x 200 diameters.—Sheppegrell, page 388.

PLATE XXXVII.



Photomicrograph of pollen plate exposed at 5,000 feet elevation, showing long ragweed and grass pollen x 200 diameters.—Sheppegrell, page 388



Photomicrograph of pollen plate exposed at 1,000 feet elevation, showing short and long ragweed pollen x 200 diameters.—Sheppegrell, page 388.

tages over kites and balloons, as long distances may be covered in a short time, and the process is directly under control.

Preliminary Test Flights. The first tests were made on June 19th, in order to determine the best length of time of exposure. The plates were exposed for thirty seconds, and one and two minutes respectively at elevations of 200, 500 and 1,000 feet. These lengths of time proved inadequate, and in the next flight the exposures were made for ten, twenty and thirty minutes at elevations of 1,000 and 2,000 feet. The twenty-minute exposure gave the best results, as the ten-minute appeared insufficient and the thirty-minute exposure to the great wind velocity caused the glycerin to dry and disappear from the slide. The glycerin film was used in the entire series. The time of the plate exposures was twenty minutes.

In the first series of tests, the exposures were made at the various levels during the ascent of the airplane. This proved tedious and difficult, and, in the last two flights of the series, this process was reversed, and the exposures made at 2,000 feet intervals during the descent. The first exposure was made at 15,000 feet, the second at 13,000, and thus continued at each odd figure in the thousand feet elevations to 1,000 feet. In the following series, the exposures were also made at intervals of 2,000 feet, but at the even figures in thousand feet the two flights thus completing the combined series in intervals of 1,000 feet. This method resulted in expediting the time of each series of tests, so that the duration of each flight was reduced to three and a half hours.

When the exposures had been made, the plates were carefully sealed in special cases, and sent to the New Orleans laboratory, where they were stained, inspected, and recorded. (Plates XXXVI, XXXVII.)

Results of Tests. An analysis of the records of these tests shows that the number of pollens in the air, under favorable conditions, is fairly uniform at altitudes of from 1,000 feet to 4,000 feet. This is shown by the record of September 24th, which in Louisiana is near the apex of the ragweed pollinating season.

2,000 feet elevation, 126 grass pollen, 3,096 ragweed pollen, 189 other pollen. Total, 3,411.

3,000 feet elevation, 63 grass pollen, 2,346 ragweed pollen, 177 other pollen. Total, 3,186.

4,000 feet elevation, 51 grass pollen, 3,192 ragweed pollen, 189 other pollen. Total, 3,432.

At elevations of 5,000 feet and 6,000 feet there was a uniform decrease in the number of pollens, but the density was still considerable.

Above the altitude of 6,000 feet there was an abrupt fall in the number of pollens, indicating that the ascending air currents, which had carried the pollens to these heights, had ceased to be operative. From 7,000 feet to 14,000 feet, the diminished numbers of pollens maintained a fair average, the plates showing about sixty-five pollens at each additional 1,000 feet elevation. At an altitude of 15,000 feet, however, the grass pollen had disappeared, and it was found that there were only eight ragweed pollens adhering to the plate.

The reason for the pollens being abundant up to an elevation of 4,000 to 6,000 feet is that they are conveyed upward by the ascending air currents to the height at which the cumulus clouds usually form.

Legislation. Since hay-fever pollens are commonly found in large numbers as high as 6,000 feet, and may thus be carried ten or more miles from their source, the effective control of hay-fever by the enactment and enforcement of municipal anti-weed ordinances is manifestly insufficient. While such laws are of undoubted assistance, complete relief can be obtained only by legislative co-operation of the various states or of the Federal Government.

The author comes to the following conclusions:

1. Airplanes furnish a practical method of testing hay-fever pollen density in the air.

2. During the pollinating season of the grasses, ragweeds and other common hay-fever plants, their pollen is found in large numbers in the air up to an altitude of 4,000 feet, and in diminished numbers (sixty-five per cent.) at from 4,000 to 6,000 feet. From this altitude to 15,000 feet the pollens are present but are relatively few in numbers.

3. Unless precipitated by rain or descending air currents, pollen clouds remain in the air during the whole pollinating season of the plants which generate them, the fallen pollen being replaced by new pollen.

4. The existence of these pollen clouds and their change of position due to descending air currents explain the increase of hay-fever pollen during the prevalence of cold winds and after sunset.

Nasal Operations in Bronchial Asthma. Local conditions and malformations of the nose have commonly been assumed to be important causes of asthma, especially since reflex relations between the nose and the bronchi have frequently been observed. M. H. Kahn[4] has analyzed ninety-four consecutive cases of bronchial asthma which have been under his personal observation for a number of years. The effect of nose and throat operations on thirty-three of these is tabulated.

Relief of nasal obstruction was obtained in fifteen cases, atrophic rhinitis resulting in two of these. In the remaining cases, the operation was of no benefit. In no case was the asthma improved. In the author's experience the nose and throat should be left alone in asthma, except when the rhinologic condition itself demands attention.

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(4) Jour. Amer. Med. Ass'n., Feb. 16, 1924.

DISEASES OF THE MOUTH

Diagnostic Importance of Tuberculous Lesions of the Oral Cavity. According to R. H. Ivy and J. L. Appleton, Jr.,[5] tuberculosis of the oral mucous membrane occurs in two principal forms—lupus, and tuberculous ulceration proper. In lupus the lesions are superficial; slowly progressive, and with little tendency to ulceration. Tuberculous ulceration is characterized by the breaking down of miliary tubercles, forming ulcerative points in almost any part of the mouth. The ulcers are irregular in shape, usually not deep, slightly undermined, and with little or no induration. Pain is fairly constant.

Histologically, typical tubercles are found. The lesions are nearly always secondary to pulmonary tuberculosis.

The importance of correctly diagnosing the condition is that not infrequently the finding of ulceration on the mouth is the first intimation of pulmonary tuberculosis. The authors report three such cases.

It is necessary to differentiate the tuberculous ulcers from simple or traumatic ulcer, syphilitic ulcer, and epithelioma.

Cancer of the Tongue. In reviewing the literature, P. E. Truesdale[6] finds that cancer of the tongue appears to be on the increase. The initial stage of the condition, as described by Butlin, may show one of the following earmarks: (1) a little plaque-like hard sore, smooth and polished, neither ulcerated nor eroded; (2) the transformation or replacement of a simple ulcer by feeling a little stiffer and a very little firmer; (3) the transformation of an entire plaque of leukoplakia into a plaque of cancer,—the difference is marked by a very

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(5) Jour. Amer. Med. Ass'n., Nov. 3, 1923.
(6) Ann. Surg., October, 1923.

slight thickening, a denser white, and furrowing in various directions, but without excoriation or ulceration; (4) transformation of one small area of a leukoplakia tongue into cancer, only marked at first by a very slight and superficial hardening; (5) a white, warty growth or compound wart, neither broken nor ulcerated, and feeling at first as if it were fixed to the mucous membrane and quite superficial.

The mid-period of the disease is the most important period because during it the growth passes from the operable to the inoperable and hopeless stage.

Symptoms. The cardinal symptoms of this mid-period as it progresses are ulceration, pain, hemorrhage, salivation, lymphatic infection, anemia, and loss of weight. The ulcerated area may have a smooth red surface, but usually it is ragged, foul, and covered with necrotic tissue which bleeds easily. Blair calls attention to the appearance of the edges of the growth, which are rolled and prominent, seldom punched and almost never undermined.

Pain is an early symptom. It is not local but referred to the region of the ear and side of the head.

Hemorrhage occurs whenever the surface is excoriated or impinged upon by carious teeth or particles of unmasticated food. Except in the later stages, bleeding is rarely of an alarming nature.

Salivation, in some degrees, is constant and troublesome from the beginning.

Cancer of the tongue, even in the initial stages, must be a local process for a period of some length. Lymphatic infection, however, has begun in too many cases before the diagnosis is established. The assumption that glandular infection does not exist because nodes are not felt is proven erroneous repeatedly when the superficial layers of the neck are laid open. In the most rapidly progressive cases the glands may be infected within a few weeks after the disease within the mouth has become actually carcinomatous. On the other hand, in rare cases there is good reason to believe that carcinoma of the tongue may exist six months or longer before the glands are involved.

One may expect to find the first invaded gland in the region of the neck corresponding to the direction of the lymph channels draining the area of the tongue which is invaded. If the lesion involves the tip of the tongue, careful palpation should be made for enlargement of the glands in the submental and sublingual groups. Cancer of the border of the tongue drains into the submaxillary gland and the surrounding lymphatic glands. One vessel runs from the neighborhood of the frenum to the deep cervical glands lying near the bifurcation of the common carotid. When the lesion involves the base of the tongue, metastasis takes place in the superior deep cervical lymphatics. These drain all parts of the mouth, fauces and upper part of the pharynx.

In moderately advanced cases of carcinoma in any region of the tongue or floor of the mouth, any or all cervical lymphatic gland groups may be found to be involved. Anemia and loss of weight are not conspicuous symptoms in the early stage.

Prognosis. The outlook in any case depends upon the age of the patient, the stage of the disease, and the method of treatment. The author reports four cases which show that, except in the aged, cancer of the tongue grows rapidly. The average duration of life of any unoperated patient is less than two years. Those cases treated surgically in the initial stage or in the early mid-period show a proportion of three-year cures of at least 30 per cent., while the operative mortality is not above 5 per cent.

Treatment. These cases should be operated as early as possible. *X*-ray and radium treatment is still questionable. Of the various surgical methods that may be employed, the author mentions that of Kocher in particular. However, he has found very great success with the cautery knife method and describes his technic as follows. With the patient in a semi-upright position, ether is administered by the intrapharyngeal method. The field of operation is prepared with iodine, half strength solution being used in the mouth. The neck dissection is done first. A transverse incision, slightly curved downward, is made from a point about 2 cm. below the lobe of the left ear to a corresponding point below the right ear. The knife is used in making the incision through the skin and dissecting back to flap. Then, with the cautery knife, the lymphatic gland bearing area is dissected *en masse* from the entire cervical region thus exposed. The hypoglossal and lingual nerve on the healthy side are carefully preserved; also the small branch of the facial nerve supplying the angulæ oris. Perforation of the floor of the mouth is occasionally unavoidably injured. This invariably complicates recovery by a disagreeable infection. On completing the dissection, the skin margins are brought together and a rubber tissue drainage is placed in either side of the neck.

The second part of the operation consists in removing a part or whole of the tongue. In the three cases reported this step was carried out in the following manner.

The tongue was drawn forward on a retention suture passed through the tip. The mucous membrane on the floor of the mouth was then incised and dissected free, the line of separation being fully 1 cm. distant from the growth. The lingual artery, standing out somewhat like a cord, was next exposed by blunt dissection and tied. The body of the tongue was then divided along the raphé, care being exercised to have the line of division extending wide of the growth. The diseased half was drawn upward and removed by cutting the geniohyoglosssus muscle and meeting the mid-line incision by a curved section at the root of the tongue. In Case II the edge of the carcinoma involved the floor of the mouth and in removing the structures here a communication was made with the neck. This was difficult to close, and complete union did not result. The secretions of the mouth drained into the neck with infection as a consequence. A sizable rubber tissue drain had been placed in the neck wound and a bad infection was thus averted.

In the author's cases, speech faculty with lingual phonetics returned, so that oral communication was established in from seven to ten days after operation. For several weeks after operation the remaining half of the tongue did not come in contact readily with the soft palate, hence the linguals d, k, t and q were pronounced with difficulty. In one case the motor function of the tongue was so interfered with that for nearly two months the patient was unable to place morsels of food between the teeth. At the end of six months all of these patients had good function of the tongue, with only a slight lisp and no embarrassment during mastication.

A Case of Glossodynia with Lingual Tonsillitis as Its Etiology: Control Through the Nasal Ganglion. This case is reported by G. Sluder[7] because it brings out lingual tonsillitis as the cause of glossodynia; but although it was established in this way, it persisted after the lingual tonsillitis, and was controllable through the nasal ganglion. Miss L. B., aged 32, developed an acute follicular lingual tonsillitis some months after the author had successfully removed the faucial tonsils. Galvanocautery destruction of most of the lingual tonsil resulted in relief and diminution in bulk of the tonsil. Six months later another acute attack occurred, this time, however, accompanied by pain in the left side of the tongue as far forward as the tip. Local application of 50 per cent. silver nitrate was followed by a return to normal of the tonsil remnant, but the pain in the side of the tongue persisted. The nasal ganglion was anesthetized and immediate relief followed. This procedure

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(7) Jour. Amer. Med. Ass'n., July 14, 1923.

was repeated two weeks later and again in one month because of recurrence of the pain. Since the last cocainization the patient has remained comfortable. The author has had six other cases of persistent glossodynia in which the nasal ganglion has been injected. Some cases require two or even three injections to produce a permanent result. Any additional aid in treating these cases is earnestly desired as the patient almost always believes he has cancer of the tongue, and it is difficult to dissuade him from this idea inasmuch as the symptoms often continue on, month after month, despite all possible treatment.

[We have observed cases of glossodynia where we believed the cause was of rheumatic origin and would suspect a similar cause for the case cited by Sluder.—Ed.]

Surgical Diathermy by the Needle Method. A Lewy[8] believes that diathermy presents distinct advantages over any other method for removal of malignant growths in the mouth and throat. The special advantages of the needle are that it does away with a considerable number of special tips, it can be placed accurately and can be made to traverse several layers of tissue with a greater probability of accurately controlling the amount and depth of tissue coagulation.

The removal of malignant growths by this method, as in other methods, should be supplemented by subsequent raying, by removal of gland-bearing tissue where necessary, and by the use of such measures and remedies as experience has proved useful.

The author reports four cases. Case 1. In a man aged 55, a squamous-celled epithelioma involved the right tonsil, both pillars in part, and the adjacent part of the tongue. The patient remained well for 9 months after the treatment, when a swelling appeared in the infraclavicular region. This eventually resulted in

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(8) Ann. Otol., Rhinol., and Laryngol., December, 1923.

death. There was no recurrence in situ. Case 2. In a man aged 53, a squamous-celled epithelioma involved the right side of the tongue, the right tonsil, and both pillars, with extensive induration toward the base of the tongue. Not even temporary relief resulted from the treatment, and the patient eventually died.

Case 3. In a man aged 66, a squamous-celled epithelioma involved the left tonsil, both pillars, the soft palate, and the posterior pillar of the right side. The entire area involved was coagulated with diathermy, and after the slough separated the original area looked well. However, there was no relief from pain, and new nodular areas soon appeared in the nasopharynx. Another attempt at coagulation was made. This brought no relief and the patient soon went into stupor and died. Case. 4. A squamous-celled epithelioma involved a man's right tonsil and tongue. There was no relief of pain until the slough separated, about two weeks after treatment by coagulation, followed by block dissection of the neck and a course of *x*-ray treatment. The patient has remained well for about two years, but has an annoying paresthesia of the right side of the tongue.

DISEASES OF THE THROAT

THE TONSILS

Some General Effects of Local Anesthetics Administered as in Tonsillectomy. E. L. Ross,[9] in a recent series of experiments on dogs, found that marked circulatory changes are produced when a local anesthetic is administered in the usual clinical manner.

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(9) Ann. Otol., Rhinol., and Laryngol., December, 1923.

Arterial pressure is greatly increased, due to the synergistic action of cocain and adrenalin when injected into the blood stream. The intracranial venous pressure is increased relatively more than the arterial pressure. The arterial pressure was increased 223 per cent., and the venous 467 per cent. If either cocain or adrenalin is omitted, the circulatory changes are negligible.

Measurements of blood pressure in persons undergoing tonsillectomies, in which cocain, adrenalin and novocain were used, indicate a regular rise of blood pressure of considerable amount, but subject to wide variations. Those cases in which the reaction was considerable showed much greater increase in blood pressure.

The results obtained lead the author to the following conclusions.

1. The minimum of cocain that will produce anesthesia is sufficiently great to sensitize the body to the action of adernalin on the blood pressure.
2. Cocain should, therefore, be eliminated wherever possible.
3. When it must be used to reduce the reflex action of gagging, it may be applied some time after the injection of adrenalin and novocain, when no synergistic action will result.
4. The amount of adrenalin with cocain should be reduced to the minimum.
5. The strength of the novocain injected, up to 2 per cent., seems to be of small significance.

A Comparative Study of the Crypt Content of Tonsils of Man, Pig, and Cow. In the crypts of the human tonsil, characteristic bodies, commonly called actinomyces-like granules, often occur. They are found, roughly, in about 30 per cent. of extirpated tonsils, and they probably appear at times in the crypts of all tonsils. They are small, nonadherent, grayish yellow, somewhat brittle, and foul smelling, and are often multiple and bilateral. On section they reveal a raylike arrangement of filaments, with peculiar brushlike structures at the margins. Smears indicate that they are made up of several varieties of organisms, the most conspicuous of which are coarse, unbranched filaments, coccal forms, fusiform organisms, and many large spirochetes.

These bodies, D. J. Davis[1] says, have been mistaken for true *Actinomyces.* Their structure, however, is very different from the latter, and they are easily differentiated from it. In an examination of granules from many hundred human tonsils, the author has not as yet encountered a single instance of *Actinomyces* occurring in the crypts. In spite of a general impression that actinomycosis of the tonsil is not uncommon, a search of the literature reveals few cases of true primary actinomycosis of this organ. It is extremely rare.

In relation to this subject are certain data in the literature, reported, in large part, years ago, concerning the occurrence of *Actinomyces* in the tonsils of lower animals, notably the hog. In view of these observations it was thought important to investigate further the nature of such bodies in the hog, especially in the light of the recent data obtained with human tonsils. Five hundred tonsils were obtained and submitted to examinations.

The hog's tonsils are large, flat and rather smooth, measuring approximately 3 by 4 cm., and in depth from 0.5 to 0.75 cm. The crypts are numerous, numbering 100 or more for each tonsil. The openings are small, and the crypt extends downward nearly to the base. On microscopic examination the crypts are seen to be lined with an epithelium, as a rule thoroughly infiltrated with lymphoid cells quite like in the human tonsil.

In the gross examination of the hog's tonsils it was common to see plant fibers projecting from the crypt lumen. At times, several might be found in one tonsil. They consisted usually of small pieces of straw or grass. On these fibers, found projecting or embedded in the crypts, *Actinomyces* granules were very commonly seen,

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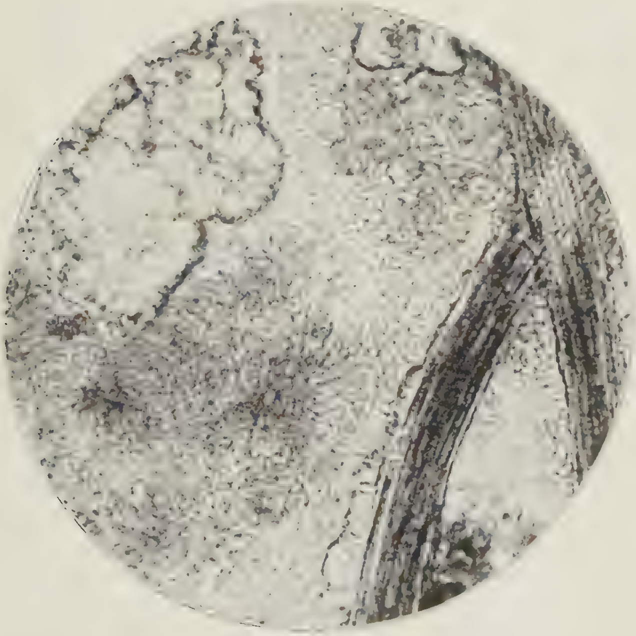
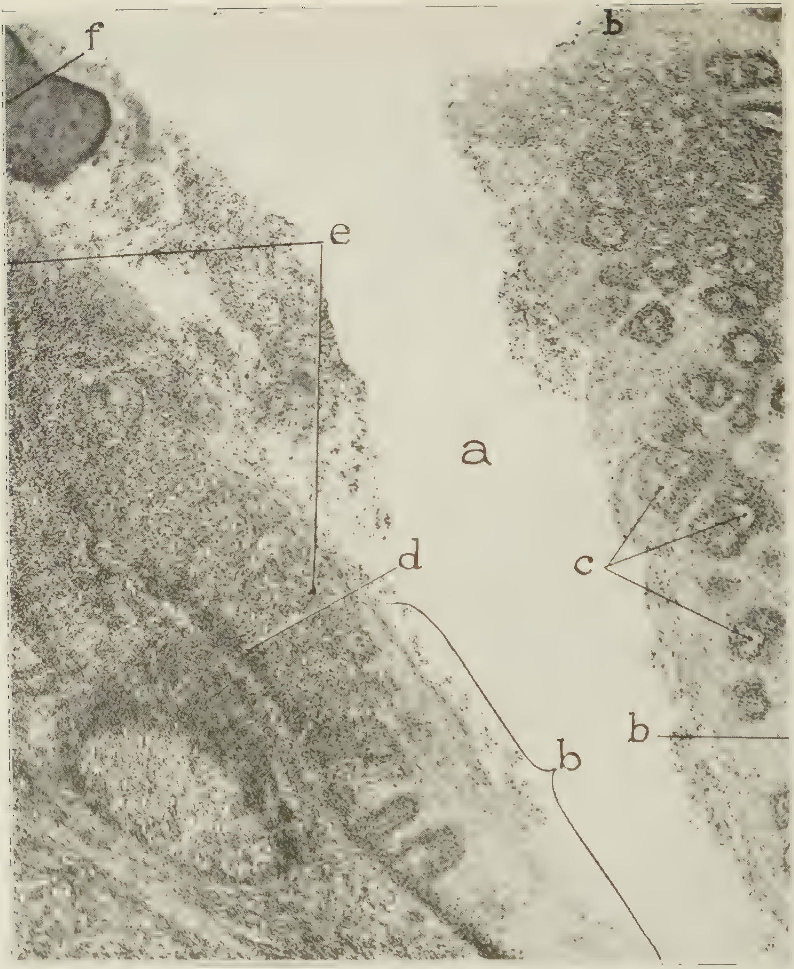
(1) Jour. Amer. Med. Ass'n., Oct. 6, 1923.

PLATE XXXVIII.



Typical Actinomyces from the crypt of a hog's tonsil; some are attached to the plant fiber; slightly reduced from a photomicrograph with a magnification of 180 diameters.—Davis, page 399.

PLATE XXXIX.



Section of a tonsil removed for infectious arthritis, with a clinical recovery; *a*, lumen of crypt; *b* to *b*, normal epithelium lining crypt; *c*, capillaries containing red blood cells; *d*, inflammatory cells in the base of an ulceration; *e*, area of destruction of epithelium; *f*, a clump of bacteria and cellular debris in lumen of crypt.—Crowe, page 402.

but usually were either in close apposition to it or growing on it along the margin. At times the filaments extended well into the fiber, and the growth was observed along the tubules of the plant structure as seen in the accompanying illustration. The granules appeared in every way typical of *Actinomyces.* Clubs were in evidence at the periphery, and gram-positive, branching filaments appeared in the centers. In hematoxylin and erosin preparations, the clubs stained red. (Plate XXXVIII.)

In the 500 tonsils examined, the percentage of embedded fibers, the percentage of fibers associated with *Actinomyces,* and the number of tonsils containing caseous plugs were noted. Several of the tonsils containing the organisms were sectioned and studied histologically in preparations stained with dilute carbolfuchsin, hematoxylin and eosin, and by an acid-fast stain. Cultures were made of buried and surface vegetable fibers and also of suspicious crypt material.

In view of the fact that the human crypts so commonly harbor large numbers of fusopirochetes both in granules and outside them, a search was also made for them in the hog's tonsil in ordinary smear preparations stained heavily with carbolfuchsin.

Eighty-six tonsils of cows slaughtered at the Union Stock Yards were obtained fresh and examined for granules and by smear preparations. Grossly, the tonsils were cut by numerous transverse incisions, and the crypts inspected. In only three of the eighty-six were pieces of vegetable fiber found, and they showed no evidence of *Actinomyces* growing on them. These consisted of pieces of straw or hay. No definite granules, either actinomycetic or of the human type, were found. Small grayish, cheesy or purulent plugs were seen in practically every tonsil, often in large numbers. At times, small encapsulated abscesses appeared with a yellow purulent content. In all these tonsils, microscopic examination of these plugs revealed no evidence of *Actinomyces.*

Smear preparations were made from the crypts of the forty-eight cows' tonsils, some from the grayish plugs, others from the crypts and epithelial surface. They were stained with carbolfuchsin and also by Gram's stain. In no instance were spirochetes or typical fusiform bacilli found. A few cocci, chiefly diplococci and ovoid bacilli, were seen.

The author summarizes his results as follows.

In man, the granules found in the crypts are for the most part composed of radiate, nonbranching, mycelial structures, fusiform bacilli, spirochetes and cocci. Characteristic brushlike terminals appear in the margin. True *Actinomyces* does not occur. Food particles and lime may be found in these granules. They are an important habitat for spirochetes, fusiform bacilli and streptococci.

In the hog, granules are very common, especially attached and adjacent to straws, and plant fibers are found frequently in the tonsil crypts. These are true *Actinomyces,* being composed of radiate, gram-positive, branching filaments with definite clubs. Here is an important normal habitat for this fungus. Spirochetes and fusiform bacilli may be found, but not constantly. Granules of the human type are not found in the hog.

In the cow's tonsil, neither the human nor the hog type of granule is found. Here occur chiefly soft, fatty, yellow masses and occasionally plant fibers. Spirochetes are not found.

Direct Blood-Stream Infection Through the Tonsils. In a previous publication in 1916, S. J. Crowe[2] insisted that the tonsils and adenoids could not be responsible for a general systemic disturbance unless there was a palpable enlargement of the lymph glands in the neck. Since then many of the author's patients who had been

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(2) Arch. Int. Med., Apr. 15, 1924.

advised against tonsillectomy, have informed him that after leaving Johns Hopkins Hospital they had had their tonsils removed and with ultimate cure. This stimulated the author again to study histologically the tonsils and adenoids removed from 3,000 patients during the past 10 years, in order to see whether a direct infection of the vascular system could be demonstrated.

The results of the investigation are summarized as follows.

The epithelium lining the crypts of the tonsil differs from that covering the surface. The crypt epithelium has papillæ and a rich network of capillaries, while the epithelium covering the surface of the tonsil has but few capillaries and no papillæ. A destruction of the crypt epithelium, in whole or in part, is the most common pathologic finding in chronic tonsillitis. In the majority of the tonsils examined microscopically the ulcerated areas in the crypts have healed; in others there are definite chronic ulcers.

These ulcerated areas are surrounded by an accumulation of plasma cells, lymphocytes and leukocytes. There is a rich network of thrombosed capillaries and lymph channels around the margins of the ulcers, and the conditions seem favorable for the passage of organisms into the lymphatic system and the liberation of infected emboli into the blood stream. Such ulcerated areas are most frequently found in the tonsils of individuals suffering from infectious arthritis, and least frequently in those in whom the tonsils were removed for acute rheumatic fever and chorea. A few of the arthritic patients whose tonsils show histologic ulcers in the crypts have no palpable enlargement of the cervical lymph glands, and the findings in these cases suggest a direct blood stream infection. This supposition is strengthened by the fact that this type of lesion in the crypt is found most commonly in patients with a variety of arthritic involvement (infectious arthritis) that responds most frequently to the removal of an infected focus and general hygienic measures. (Plate XXXIX.)

[Clinical observation, when acute rheumatism, acute nephritis, and endocarditis follows directly on an attack of acute tonsillitis, is not uncommon where the lymphatic chain is not palpably enlarged.—Ed.]

The Bacteriology of Extirpated Tonsils and Its Relation to Epidemic Tonsillitis. Owing to the marked seasonal variation in the incidence of tonsilitis, T. Nakamura[3] studied the bacteriology of 2,048 tonsils removed during a period from July 1, 1922, to June 30, 1923.

The tonsils were removed on account of recurring attacks of tonsillitis or, more often, because they were believed to be foci of infection in patients suffering from ulcer of the stomach, chronic infectious arthritis, myositis, cholecystitis, nephritis, etc. One tonsil from each patient was placed immediately in 10 per cent. formalin; the other was sent to the laboratory for cultures.

From the results obtained the author comes to the following conclusions.

A point of particular interest regarding the results of the cultures is the relative increase in the number of hemolytic streptococci which occurred in December and lasted throughout the winter months. At about the time when the hemolytic streptococci became predominant, an epidemic of tonsillitis and sore throat developed in Rochester, continuing until about the middle of April, when the relative number of hemolytic streptococci became noticeably less. The patients from whom the tonsils were removed had no acute inflammation of the tonsils at the time of tonsillectomy, nor was there a history of attack shortly before. In view of the fact that most of these patients came from widely separated regions, there is reason to believe that the increase in hemolytic streptococci during the winter months

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(3) Ann. Surg., January, 1924.

occurs generally, and that the increased incidence of hemolytic streptococcus tosillitis is due more to climatic conditions than to contact infection. It is well known that accidental infections incident to surgical operations, usually due to hemolytic streptococci, are more prone to occur during epidemics of infections of the upper respiratory tract. This study demonstrates that the number of hemolytic is streptococci in the tonsils of persons without history of actual infection becomes unusually large during the winter months when tonsillar infections are prevalent, and it warrants the suggestion that extraordinary care be taken to prevent contamination of instruments, the field of operation, etc., from the mouths of the personnel of the hospital operating rooms.

From the author's study, it may be concluded that streptococci occur more commonly and in larger numbers than other bacteria in the parenchyma of extirpated tonsils. The incidence and relative number of hemolytic streptococci increase with the coming of cold weather and the prevalence of tonsillitis and allied conditions.

Tuberculosis of the Tonsils and Adenoids. A Clinical and Roentgen-Ray Study of 50 Cases Observed for Five Years After Operation. P. B. MacCready and S. J. Crowe[4] state that from a review of the literature it may be concluded that in a majority of cases of tuberculous tonsils and cervical gland in children, the condition is primarily due to drinking milk from infected cows. The histologic examination of the tonsils and adenoids removed at operation in a series of 3,260 cases resulted in the discovery of tuberculous tonsils or adenoids in 138 patients.

Of these patients, 40 have been kept under observation from 5 to 10 years, and 10 for at least 2 years. Each patient had a roentgen-ray examination of the chest, and a general physical examination at least once a year since the removal of the tonsils and adenoids. That

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(4) Amer. Jour. Dis. Child., February, 1924.

tuberculosis of the tonsil is usually of bovine origin is indicated by the age incidence (over 5 per cent. of these cases were less than 10 years old), the frequency of cervical and mediastinal lymph glands, the low incidence of pulmonary, intestinal and other complications, and the excellent general condition of these children in spite of *x*-ray evidence of tuberculosis of the mediastinum.

Removal of tonsils and adenoids is of value as it reduces the secondary infection, but there is no evidence that operation on the throat removes the only tuberculous focus in the body. Tuberculosis of the tonsils and adenoids is never recognizable from the gross appearance before operation. When the lesion is discovered microscopically, it is not advisable to alarm the family and to stigmatize the patient as tuberculous, since the majority of such patients will never have clinical symptoms of the disease.

Tonsillar Infection and Systemic Disease. In an editorial[5] the author says that the importance of the tonsils as a portal of infection or primary foci in certain cases of systemic disease is now established beyond any reasonable doubt. No reasonable man would suggest that the tonsils are the primary focus in all cases of arthritis, nephritis, or the many other diseases where a focal infection seems likely to have been the starting point, but it certainly has been established that they frequently are at fault and should be carefully considered and investigated in all such cases.

Possibly the tonsil has received an undue share of blame and attention from the fact that it lends itself to the method of elimination in the search for all possible foci of infection. With the public demand for efficiency and action on the part of the medical man, the tonsil is possibly sometimes needlessly sacrificed in grasping at a forlorn hope in the treatment of some refractory disease.

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(5) Can. Med. Ass'n. Jour., January, 1924.

Health survey workers seem to have a stock question: "How about your tonsils?" and to the physician or to the nose and throat specialist an appeal is constantly made to give a ruling in some individual case.

The subject may be considered under two headings.

1. What are the indications of focal infection in tonsils?

2. What is the prospect of improvement likely to follow the removal of infected tonsils,

Indications of infection may be (*a*) manifest or (*b*) latent.

(*a*) Manifest cases are those with gross inflammatory changes in the tonsils or a history of frequently recurring attacks of acute or sub-acute inflammation in the tonsils.

(*b*) Latent cases, on the other hand, are those where the systemic effects of a focal infection are the chief indication of trouble. There may be complete absence of any local symptoms, with or without evidence of infected foci in the tonsils on careful investigation. In all cases it is essential to exclude all other septic foci by careful general examination, and the teeth must be especially investigated before condemning the tonsils. Other regions of special importance are the nasal accessory sinuses, the prostate in men, and the pelvic organs in women.

The taking of cultures from the tonsils, while it impresses the public, does not seem a very sound method of examination when one considers the vast amount of infection always present in the mouth.

2. The prognosis will depend, first, on how well the tonsil is established as the cause of the disease and, secondly, on how far the disease has progressed and how much damage has been done before operation.

In a simple arthritis due to tonsillar infection the results are most satisfactory and perfect recovery takes place. On the other hand, a badly damaged heart or kidney will not be restored by operation, but this may sometimes offer a hope of limiting the progress of the disease by lessening the danger of recurrent acute attacks. The question is not one that can be reduced to figures and percentages, but each case must be considered individually by the internist and laryngologist together. In conclusion it cannot be too strongly urged that where a tonsil is to be dealt with as a focus of infection a complete and careful removal is the only operation that should be considered.

[In all cases where the chief indication for removal of the tonsils is the presence of a suspected systemic infection, that is, when the local indication of a manifest tonsil infection are absent, it seems advisable to leave the question of their removal with the internist. who is best able to judge regarding the existence of systemic infection and the possibility of other foci of infection apart from the tonsil.—Ed.]

The Tonsil and Focal Infection. G. S. Dowell[6] states that the tonsils possess far more importance in the production and dissemination of disease than is usually accorded them. The crypts of the tonsil, usually twelve or fourteen in number, are especially adapted as culture tubes. Some of these crypts are open and some are not. The ones that are not are the ones that are the most harmful. Drainage here is like that in any other part of the body, the better the drainage of a cavity that needs it, the less danger of systemic infection. By repeated attacks of tonsillitis many of the crypts close by exudation from inflammation. Some of these crypts are very deep and decomposed food with bacteria are found in abundance.

The question of what kind of tonsil, either the submerged or pedunculated, should be removed, is often asked. The erupted or pedunculated tonsil, which is observed in children, is almost always associated with adenoids, and in such children we find stunted growth,

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(6) Jour. Missouri State Med. Ass'n., March, 1924.

both physically and mentally. This being the case, there is no doubt what the treatment should be. The submerged are usually found in adults; this type has no means of drainage, and offer all the symptoms of a focal infection which is far-reaching in its effects on the patient. Interference with drainage of the tonsil is a fruitful cause of infection. Sometimes we look in a throat and see what appears to be a very inoffensive tonsil. In this case, if a small wood tongue blade, or any flat instrument is used, and one begins at the base of the tonsil and pushes outward and upward, pus will exude. This apparently harmless structure may be instrumental in implanting serious disease or perhaps destroy life. The submerged tonsil with large spongy upper lobe hidden in the supratonsillar fossa is the one commonly associated with focal infection. Again, the large spongy tonsil is to be regarded as a possible source of infection whether out in the throat or buried beneath the pillars of the fauces. We should have some routine method of examination. First, look for areas of dusky redness along the inner border of the anterior pillars; second, determine the consistence of tonsil; third, see if they are congested; fourth, look for lymphatic nodes at the angle of the jaw, and whether they are painful. As to the exuded material from the tonsil, we can find the streptococcus aureous and albus. According to internists the streptococcus hemolyticus has a special predilection for heart muscle.

Tonsillectomy is not yet a perfect operation, nor is it an absolutely safe procedure. There are so many things can happen in the short time that it takes to do a tonsillectomy. There may be difficulty from bleeding, and in such cases those that have done this work know how difficult it is to get all the tonsil. No surgeon should undertake the operation lightly. He should be equipped with all the necessary appliances as well as a knowledge of this work.

According to the advocates of x-ray and ultra-violet rays, some day we will have a perfect treatment for diseased tonsils without the attendant dangers and loss of time incident to the present mode of treatment.

It has been the author's good fortune to examine lately one woman that had subjected herself to this treatment. Inspection of the throat showed the fossa tonsillaris quite large and also fairly empty, but a few crypts that yet remained and these crypts still appeared infected.

The Indictment of the Tonsils. While removal of the tonsils, when indicated, is usually followed by gratifying results, G. H. Gettinger[7] does not believe unbounded enthusiasm should lead to radical excesses. While the rôle of the tonsils cannot be categorically stated, there are sufficient experimental data to prove that these appendages have physiologic usefulness.

Five tenable theories have been advanced as to the function of the tonsil: (1) that the tonsil protects the organism from bacterial invasion; (2) that it provides an internal secretion; (3) that the tonsil has a hematopoietic function; (4) that it possesses an eliminative function; (5) that it plays a part in the production of immunity, *i. e.*, that invading organisms are held in the tonsil and that the toxins are absorbed in sufficient quantities to produce antibodies in the host.

In indiscriminate tonsillectomy these functions are entirely disregarded. Many clinicians feel that tonsillectomy intensifies the predisposition to subsequent infection. If we assign to every tonsil the prejudice of rheumatic and cardiac perniciousness, the prevalence of these conditions should be infinitely greater than they are today.

The Indications and Contraindications of Tonsillectomy. A series of 204 cases treated by tonsillectomy and followed up during the past 4 years, is reported by E. Fernández Soto[8]. The author states that ablation of the tonsil removes no essential organ, and if the tonsil has an internal secretion, it is only such as is common to all lymphoid tissues. Among the indications for tonsillectomy are mentioned: (1) Chronic and otherwise incurable disease of the tonsil; (2) repeated angina, fever and chronic bronchitis, in the presence of purulent secretion of the nose and persistent tonsillar infection; (3) in certain cases mouth-breathing, persisting after various nasal operations, is cured by removal of the tonsils; (4) enlarged and cervical glands in connection with tonsillar infection; (5) in deafness due to obstruction of the eustacian tube in arthritis or other infection derived from the local infection of the tonsil; and (6) in apyretic tuberculosis tonsillectomy may be recommended if the general condition is good, and if angina and laryngitis recur. Local anesthesia should be employed.

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[7] Arch. Pediat., January, 1924.
[8] Rev. españ. de laringol., May-June, 1923.

Tonsillectomy should not be resorted to indiscriminately. (1) In many cases of so-called tonsillar hypertrophy it is contraindicated; (2) it is contraindicated by unfavorable general conditions, and by acute and subacute local inflammation; (3) it should be postponed for at least 3 weeks after recovery from angina, should be delayed if bronchitis is present, and should generally be avoided before the sixth year of age. More blood is lost after ablation of tonsils and adenoids than through ordinary abdominal operations; (4) transillumination and bacteriologic methods are insufficient as guides to operation in tonsillar infection; and (5) operation is not advised in asthma or reflex nasal neuroses, in slight fever of obscure origin, or for impaired nutrition unaccompanied by chronic tonsillar infection.

Incision of the tonsil and the use of *x*-rays, vaccines, etc., do not cure chronic infections of the tonsil. The author advises that after tonsillectomy adults should remain in bed for 2 days, children for 5 days. Children who are permitted to leave the bed earlier usually lose three or four pounds in weight. Tonsillectomy should be permitted only with the concurrence of the internist in cases where the affection is remote from the tonsils.

The Reaction of the Peritonsillar Tissues to Tonsillectomy. A Study in the Etiology of Post-Tonsillectomy Pulmonary Abscess. In post-tonsillectomy pulmonary abscess, the infection must reach the lung either by way of the trachea and bronchi, the venous system, or the lymph channels. From a careful consideration of the literature G. Fetterolf and H. Fox[9] conclude that the inhalation theory should be given a less important place than it has hitherto occupied.

The authors thought that a minute study of the pharyngeal and cervical region following tonsillectomy would show exactly what happens as a result of the operation. The examination of the peritonsillar tissues and of the venous and lymphatic tissues draining the tonsil area might afford information as to the probable origin of lung abscess.

The results of their experimental work show that injected material traveled from the tonsil to the drainage node next in series in half an hour or less. Traumatism was manifested not only at the immediate site of the operation, but also in collateral tissue, in the form of hemorrhage and cellular infiltration, with resultant degeneration of such deep structures as muscle and salivary gland. Many venous thromboses were seen, both near the surface and deeper. Bacteria were easily found in the surface exudate, and in the vicinity of infected stitches.

The authors believe that as trauma, sepsis, and muscular action are the principal factors in the formation and dislodgement of thrombi, the actively muscular pharynx is a particularly favorable region for the dislodgement of such thrombi into the superior caval circulation. Many cases of pulmonary embolism escape notice on account of their small size, sterile character,

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(9) Amer. Jour. Med. Sc., December, 1923.

and quick resolution of the thrombi. While post-tonsillectomy lung complications may at times be of inspiratory origin, such origin is not as common as has been thought. The lymphatic origin is also rare. The authors suggest that the routine use of needle-carried sutures for tying bleeding vessels be abolished since it carries possibilities of infection, and that surface tying be used instead.

From these studies the authors feel that our ideas in regard to the capsule of the tonsil may undergo a change. It may be found that the capsule forms too good a bulwark to the peritonsillar tissues to allow of its being taken away.

Apparent Deformities of the Pillars of the Fauces, Seen After an Ideal Tonsillectomy. The cause of apparent deformities in the pillars of the fauces is due to anatomical variations in their structure. F. J. Pratt[1] states that an ideal throat has large muscular pillars, the anterior pillars being about one-third the size of the posterior pillars. He describes the anatomy of the palato-glossus and the palato-pharyngeus muscles.

The variations which the author mentions are as follows:

1. Large muscular posterior pillars and thin anterior pillars. This is the most common variation.

2. Large mucular anterior pillars and small posterior pillars. The anterior pillars stand out well; the small posterior behind the anterior, at first glance, look as though they had been removed.

3. A large muscular posterior pillar and a thin anterior pillar on one side and a large muscular anterior pillar and a thin posterior pillar on the other. (Plate XL.)

4. Fairly large anterior and posterior pillars, but the posterior pillars one-third to one-half way down blend into the muscular wall of the pharynx.

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(1) Minn. Med., April, 1924.

5. The pillars on one side normal, but on the other side the posterior pillar one-third to one-half way down blends into the muscular wall of the pharynx.

6. Both anterior and posterior pillars narrow and contain a small amount of muscle tissue.

7. The pillars on one side normal, but on the other side the posterior pillar comes off high up behind the anterior pillar. (Plate XLI.)

The ideal pillars are generally found in the patients with large throats and tonsils of medium size.

The pillars in the throats of patients with large tonsils tend to be small; whether the large tonsils cause small pillars, or small pillars large tonsils, the author is unable to say.

Thin pillars or pillars with small amount of muscle tissue tend to collapse after a tonsillectomy, as there is not enough muscle tissue to hold them out, but plainly show if the patient gags.

A careful examination of a throat before a tonsillectomy will tell just the kind of a throat to expect after a tonsillectomy, providing the muscle tissue has not been injured during the operation.

Prophylactic Vaccination Against Acute Tonsillitis. In the course of a bacteriological and epidemiological study of acute tonsillitis it was found that carriage of beta-hemolytic streptococci in the tonsils seemed to prevent attacks of this disease. In brief, among forty-nine carriers one case occurred, an incidence of 2.5 per cent., whereas among fifty non-carriers there were twenty-eight or 56 per cent. of cases of acute tonsillitis during a period of six months. It appeared that resistance was directly related to the continued presence of the streptococcus in the carrier and that a high degree of susceptibility was rapidly re-established after the carrier state was terminated. These observations seemed to A. L. Bloomfield and A. R. Felty[2] to furnish a rational basis for prophylactic vaccination.

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(2) Johns Hopkins Hosp. Bull., August, 1923.

Ninety non-tonsillectomized young women student-nurses were the voluntary subjects of the experiment. Control culture for the presence of beta-hemolytic streptococci in the throat and tonsils had been previously made and the appearance of the tonsils noted. The period of observance was five months. A polyvalent vaccine was prepared from twenty-one strains of beta-hemolytic streptococcus recently isolated from cases of acute follicular tonsillitis. Of the ninety members of the group, thirty-three were carriers. Of these, seventeen were vaccinated and sixteen used as controls. Fifty-seven were non-carriers, and of this number eighteen received the vaccine. Vaccination was given subcutaneously in three doses of 75M, 100M, and 125M, at intervals of one week. Mild, local reactions and slight general malaise followed. In no case was the subject incapacitated. The results of the experiment are summarized in the following table:

Carrier	Vaccination	Number	Cases of Tonsillitis
X	X	17	None
X	O	16	None
O	O	39	12-31.0 per cent.
O	X	18	3-16.7 per cent.

No case of tonsillitis occurred in the group of carriers, whether vaccinated or not. This is in accord with previous observations. In the group of non-carriers there were fifteen persons who developed the disease, the majority being in those unvaccinated. The bare percentage, however, fails to give an accurate idea of the comparative degree of disability in the two groups. All but one of the unvaccinated cases were severe, while the three cases among the vaccinated were so mild as to be almost subclinical.

Deep Roentgen and Radium Therapy in Carcinoma of the Tonsil. According to G. W. Grier[3] radium is now being almost universally recommended in the treatment of this condition. The author's experience with

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(3) Amer. Jour. Roentgenol. and Rad. Therap., June, 1924.

surgery followed by radiation has not been very satisfactory. In applying radium the author now recommends using the radium needles, which are imbedded in the lesion. Previously 25 to 50 mgm. of radium were held against the tonsil by means of the ordinary tonsil clamp, as used to check hemorrhage.

Of six cases treated by introducing radium into the tissues, five have shown the lesion healed completely. It would seem that fairly satisfactory results may be expected from this method in so far as the primary lesion is concerned. Radium emanation should be preferable if it is available.

The treatment of the metastatic glands in the neck is more difficult. The author has tried the following: (1) surgical operation followed by insertion of radium into the wound at time of operation; (2) operation followed by roentgen-ray treatment; (3) radium applied externally without operation; (4) the roentgen-ray appplied externally without operation. Of these methods the only one which has resulted in complete disappearance of the growth without recurrence is the high voltage roentgen-ray treatment. The author reports ten cases showing the results obtained in treating the primary lesion and metastases by the various methods indicated. In conclusion he states that the best results have been obtained with deep therapy over the glands of the neck before anything is done, and this followed by the use of radium on the primary lesion.

A New Technique for the Removal of Tonsils with Complete and Definite Hemostasis Following the Principles of General Surgery. O. M. Steffenson[4] states that the blood supply of the tonsil is carried on through five or six arterial trunks accompanied by their respective veins. The anatomic disposition of these vessels is practically constant but their relative size is subject to considerable variation. In children the upper branches are as a rule the larger while in adults the tonsillar branch of

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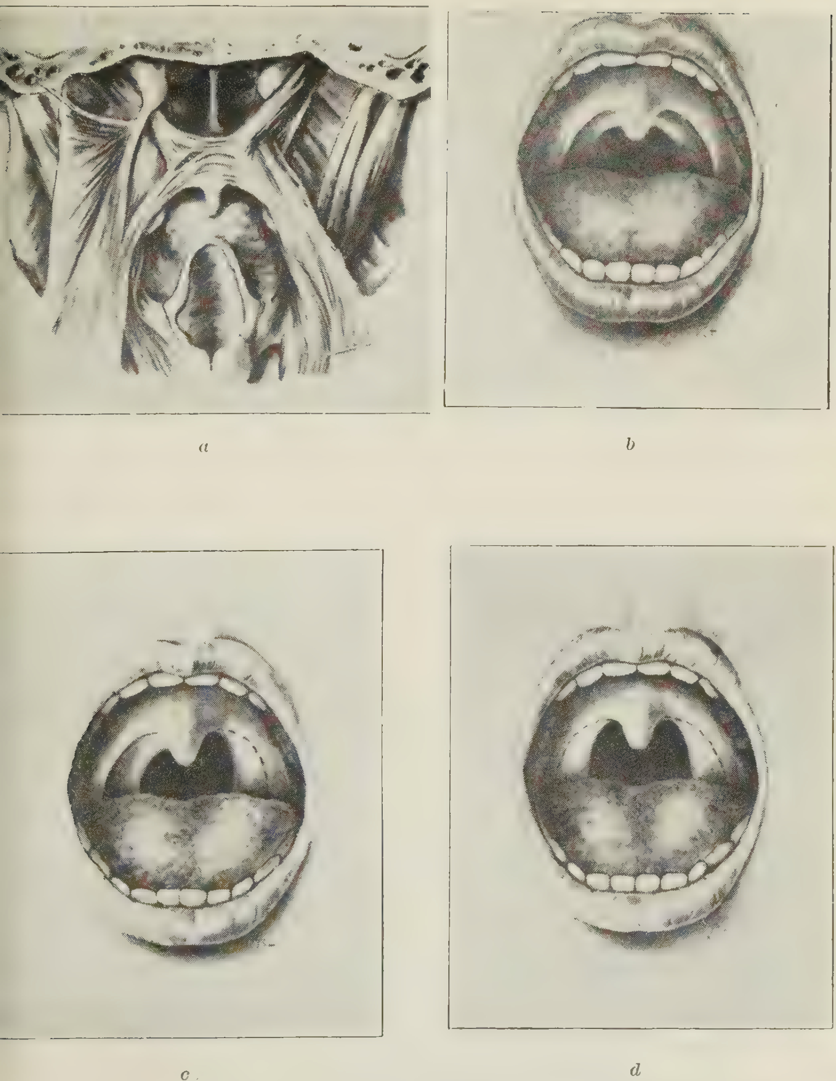
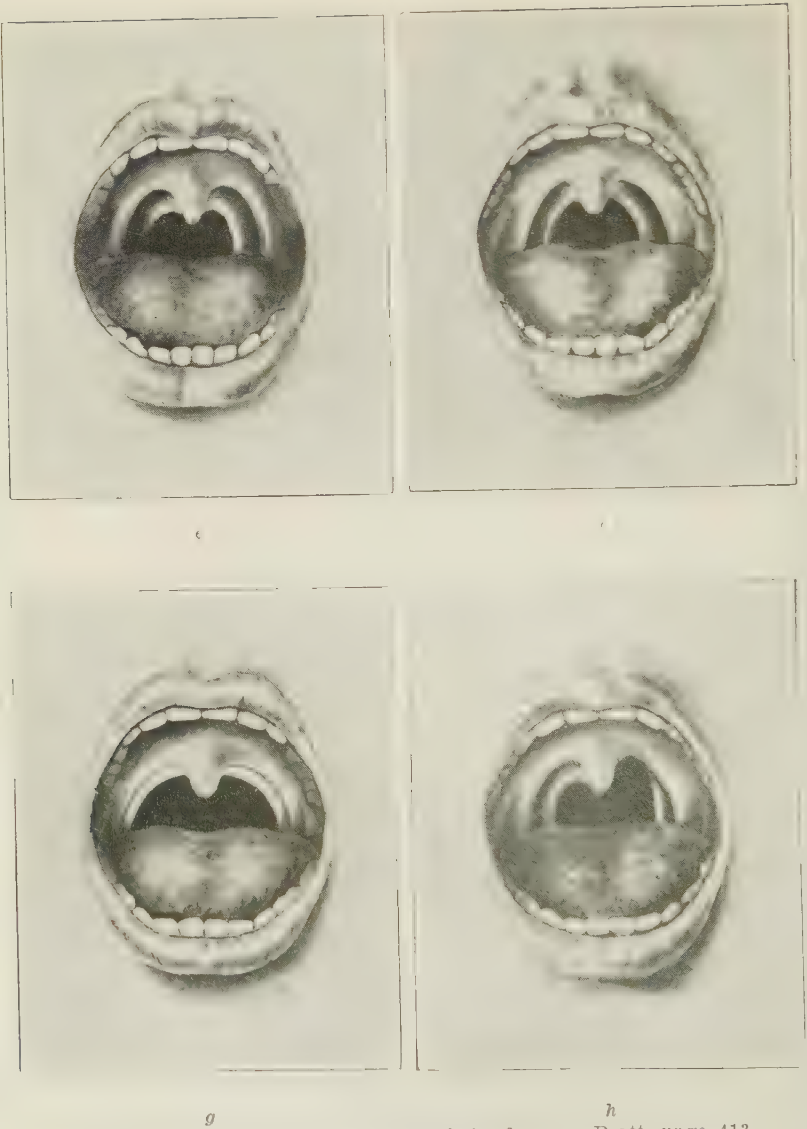
(4) Illinois State Med. Jour., November, 1923.

PLATE XL.



a, Muscles of the posterior pillars from behind; *b*, *c*, *d*, apparent deformities of the pillars of the fauces.—Pratt, page 413.

PLATE XLI.



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f

g

h

Apparent deformities of the pillars of the fauces.—Pratt, page 413.

the facial usually forms the main blood supply. The unusual variation in the size of vessels so frequently encountered in adults is undoubtedly the result of previous inflammatory reactions in the tonsil and peritonsillar structure occluding some vessels and causing compensatory dilation in the other blood channels.

The blood vessels of the tonsil do not enter the capsule or the extra-capsular portion of the tonsil in haphazard fashion but reach these structures through a vertical plane corresponding to a continuation outward of the external meridian of the tonsil mass. So constant is this arrangement that any tonsil may be dissected from the surrounding tissue beginning at the anterior and the posterior capsule rim and continuing toward the external meridian without meeting any of the main branches.

Dissection of the tonsil carried on from the anterior rim of the capsule to its external meridian and followed in the same manner from the posterior rim forward to the external meridian will reveal the vessels of the tonsil running parallel to each other from above downward and at right angle to the external meridian in a fan-shaped portion of tissue connecting the tonsil to the bucco-pharyngeal fascia.

The fan-shaped tissue produced by dissection contains the blood vessels and has an average thickness of one line. It extends longitudinally like a fin on the back of the capsule from the middle of the velar lobe above to the tip of the extracapsular portion of the tonsil below.

The author's technic is as follows.

An incision is made through the mucous membrane at its junction with the capsule of the tonsil and continued completely around the margin of the tonsil as close to the crypt area as possible in order to save a maximum portion of membrane to cover the pillars.

The tonsil mass is then grasped by means of a suitable forceps and pulled toward the median line of the pharynx exposing the anterior rim of the capsule.

The tonsil is then separated from the tissue connecting it with the bucco-pharyngeal fascia by means of blunt dissection, in the direction of the external meridian of the capsule—half of the dissection being made from the anterior rim of the capsule in a posterior direction and half from the posterior capsule rim forward, continuing as far as the vessel area.

On approaching the external meridian from in front and from behind the vessels will be seen in the fan-shaped portion of tissue produced by the dissection.

At this stage of the operation care must be taken not to wound the blood vessels in the fan; however an accident of this kind would not materially interfere with the method as the traction maintained on the tonsil keeps the field practically dry until the fan is ligated.

Ligation of the Fan. The fan, consisting of areolar tissue and a small amount of connective tissue derived from the bucco-pharyngeal fascia, has an average width of one-eighth inch and contains the entire circulation of the tonsil.

The ligation of the blood vessels situated in the fan is a relatively simple matter and may be accomplished by the use of No. 0 catgut ligature threaded on an ordinary small curved needle, or a special carrier may be employed with advantage for the purpose of introducing the catgut ligature.

The fan is ligated from above downward by means of a series of ligatures, each suture containing about one-quarter inch of the fan in its grasp. As each suture is made the tissue uniting that portion to the capsule of the tonsil is severed. Three or four sutures are usually required to ligate the blood vessels of the fan.

This method of tonsillectomy is a definite surgical procedure in which hemotasis is adequately provided for, and not left to chance or uncertain clamping devices.

Further Experiences in the Use of Tissue Juices in Tonsillectomy. In the removal of the faucil tonsils there are three chief considerations, aside from the anesthetic: (1) the prevention of hemorrhage; (2) the lessening of trauma; (3) the avoidance of infection. J. B. Greene[5] thinks that infection is largely due to hemorrhage and trauma, and these causes can be greatly reduced by his method of technic.

The author discusses the clotting of blood and mentions the theories of Morawitz and Howell. He also states that brain surgeons have long made use of tissue juices to facilitate clotting in troublesome hemorrhage. The various tissue extracts on the market are prepared from calves' brains.

The author's technic is as follows. The tonsil is seized with forceps and the upper third is carefully dissected, using by preference sharp or semi-sharp instruments. Should vessels of any importance be encountered during this stage of the operation the tonsil is at once pushed back into the fossa and held firmly till bleeding is controlled. When the upper part of the tonsil has been sufficiently dissected the wire loop is slipped over the tonsil and its removal accomplished by slow action of the wire snare. The time required for this step is about one minute for each tonsil. The last and most important step in the operation after its complete severance is the holding of the tonsil firmly and accurately in its fossa for a period of about two minutes. This may be done by the assistant, and it should be borne in mind that the gland is at no time taken from its position in the fossa until about two minutes have elapsed, to insure the closure of the mouths of the vessels with a firm clot. As a rule, though of course there are exceptions, it is not necessary on removal of the tonsil to sponge the fossa to control any immediate post-operative bleeding, and rarely is it necessary to catch a bleeding vessel. The avoidance of sponging and the use of forceps in the wound will greatly lessen trauma. Although the incidence of shock in varying degrees of intensity is still not perfectly understood, yet it is a

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(5) Boston Med. and Surg. Jour., Aug. 9, 1923.

well recognized fact that hemorrhage and trauma are important factors in its production. It is a well-known fact that young children, and those of all ages whose health is below par, withstand the loss of blood badly. The fact that so many of our patients requiring operation come within this class makes it desirable to emphasize the importance of conserving all blood possible.

The objection which has been offered to this method of the control of bleeding is the supposed danger of introducing the infection present in the tonsils into an open wound. This danger appears very remote for the reason that the severed side of the tonsil is not the infected area of the gland. There is quite as much danger of carrying infection with a surgical sponge for the reason that the mouth is a natural habitat of various infectious organisms.

In conclusion the author emphasizes the following points.

1. The application of the tonsil itself to the open vessels of the fossa controls bleeding more effectually than the usual method of sponging.

2. This technic conserves the patient's blood and at the same time lessens trauma.

3. In the reduction of hemorrhage and trauma the danger of infection becomes less and convalescence is hastened.

Indications for Roentgen Therapy in Chronic Tonsillitis and Pharyngitis. According to W. D. Witherbee,[6] roentgenotherapy given prior to operation materially lessens the amount of dissection necessary for the removal of tonsils, thereby decreasing the possibility of complications.

The author states that roentgenotherapy is recommended in the following cases:

1. Those cases in which an anesthetic or operation is contra-indicated.

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[6] Amer. Jour. Roent. and Rad. Therap., April, 1924.

2. Those cases past middle life where hemorrhage may cause complications due to a mild or severe arteriosclerosis.

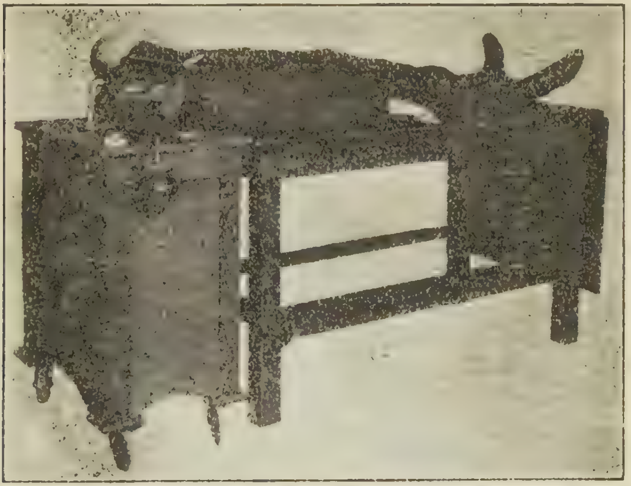

Fig. 17.—Patient in position for treatment of left side. Headrest tilted at angle necessary to avoid passing the ray through the angle and ramus of the jaw.

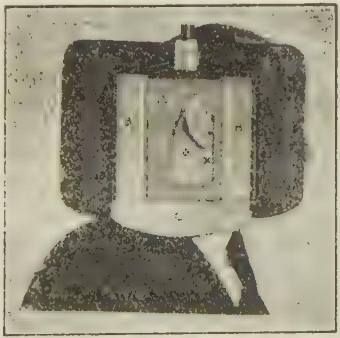

Fig. 18.—Area exposed. X is the angle of the jaw; ✱ indicates the point of entry of the central beam.

3. Patients whose tonsils are embedded in infected tissue in which the operation may cause dissemination of septic emboli into the blood and lymph streams, and produce lung abscess, septicemia, endocarditis, etc.

4. Patients whose adjacent lymphatic structures (not removable by operation) are markedly infected.

5. Patients suffering from chronic cardiac lesions, Bright's disease, diabetes, exophthmalic goitre, chorea, rheumatism, hemophilia, asthma, tuberculosis, status lymphaticus or any condition which has lowered the patient's general resistance.

6. Patients subject to frequent attacks of peritonsillar abscess (quinsy).

7. Vocalists and public speakers subject to frequent attacks of tonsillitis and pharyngitis.

8. Patients suffering from recurrent attacks of pharyngitis after removal of tonsils and adenoids.

Some of the unfavorable results obtained by this method may be accounted for by the fact that the ray was directed through angle and ramus of the jaw instead of through the soft tissues behind the jaw.

The accompanying illustrations show the positions and angles recommended by the writer.

[Reduction of the tonsil by Roentgen treatment does not appear to do away with the infection in these shrunken glands, nor does it eliminate the possibility of attack of acute tonsillitis. The one outstanding indication for the ray treatment is for the postoperative conditions in the pharynx that occasionally persist after tonsillectomy and constitute a persisting menace.—Ed.]

Late Results Following X-Ray Treatment of Chronically Infected Tonsils and Adenoids. *X*-ray treatment of infected and hypertrophied tonsils was begun in September, 1921, by C. A. Waters.[7] The purpose was to determine (1) whether the same clinical results could be accomplished as in tonsillectomy and adenoidectomy, and (2) whether there was a persistence of the carrier state.

The results of this work were based on the records of 21 cases treated, but as the records are incomplete in 9 cases, discussion is limited to the results in 14 cases.

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(7) Southern Med. Jour., October, 1923.

All these cases were seen in the out-patient department of the Johns Hopkins Hospital and all of them were suffering from infected tonsils and adenoids.

Before the treatments were started, swabs were taken from the surfaces of both tonsils and the nasopharynx and cultures were made according to the method of Bloomfield.

The distances between the two tonsils were measured and recorded by one person, Dr. J. W. Baylor, in order to minimize the source of error. The cases were grouped as follows:

Chronic tonsillitis, ten cases.

Sydenham's chorea with chronic tonsillitis, one case.

Chronic infectious arthritis with chronic tonsillitis, one case.

Chronic suppurative otitis media with chronic tonsillitis, one case.

Acute catarrhal otitis media, one case.

During the past year fifty more cases have been added to this series, and while the bacteriological data are incomplete, the clinical course following the treatments is sufficiently characteristic to warrant a statement. The following discussion, however, is limited to the fourteen cases in which the records are complete.

The author discusses the technic of the *x*-ray treatment; that of Murphy was followed. From the results shown in the tables he concludes with the following discussion.

Certain outstanding features at once become apparent upon even the most casual perusal of the tables. Of eight patients who received the full course of eight radiations, five were free from the hemolytic streptococcus and staphylococcus aureus at the time of the final cultures. Of these five, three may be considered as incomplete studies, inasmuch as a control set of cultures was not taken at the end of at least four weeks following the last treatment. Two patients were therefore free from the bacteria under consideration after the lapse of a considerable interval following treatment. These have not again been observed to determine whether this freedom persists. Three patients continued to yield to hemolytic streptococcus and staphylococcus aureus in large numbers at the end of the stated interval, and this, despite the fact that with two of them there was a certain tendency for the hemolytic streptococcus to disappear during the two courses of treatment. In the other case, the carrier state appeared and persisted in an individual (W.R.) whose flora was at first free from the organisms. The tendency for the organisms to disappear during the treatment is also illustrated by the incomplete cases, but consideration of the cases W. R. and B. S. will show how fallacious it would be to draw conclusions without the aid of later control cultures.

From the point of view of the individuals concerned, this 40 per cent. success, of the permanence of which there is even now no assurance, can scarcely be regarded as dramatic. Six of the eight individuals harbored the hemolytic streptococcus upon the surface of the tonsils before the institution of irradiation. Of the remaining two, one showed a moderate number of the organisms one month after treatments were ended. This may be regarded as a definitely bad result, viewed from the standpoint of phophylaxis. The other yielded the organism at various times during the course of the treatment, and it is attractive to presume that the tonsillar crypts in this case acted as foci from which the bacteria occasionally made their way to the surface. The observations of Pilot and Davis, who succeeded by the swab method in culturing the hemolytic streptococcus in only 61 per cent. of cases from hyperplastic tonsils (which, after enucleation, yielded positive cultures from the crypts in 97 per cent.) bear directly upon this point. Of similar import are recent observations of Davis, and of Bloomfield, that serial swabs from the throats of normal individuals will eventually reveal the presence of these organisms. Similarly, there is no proof that in the two cases from which the author was apparently successful in banishing the pernicious elements of the flora, they did not continue to exist in secluded pockets not reached by the ordinary swabbing. It is entirely reasonable that serial quantitative cultures from these children's throats would eventually disclose the undesirable organisms in either or both.

5. The *x*-ray treatment of tonsils and adenoids is especially indicated in those cases where a surgical operation is inadvisable, such as chorea, pulmonary tuberculosis, and cardiac and renal lesions. It is the author's impression that the greatest field of usefulness will be in the treatment of children. Children rarely have a chronic infection of the tonsils comparable to that of adults. Their tonsils and adenoids are very cellular and of the type that responds most readily to roentgenotherapy. Their symptoms are largely due to hypertrophy of the lymphoid tissue in the throat and nasopharynx. It is possible that when the technic is perfected roentgen-ray or radium treatment will entirely supplant surgical measures in children.

It is now over a year since the first cases were treated and during that time eight of them have returned for tonsillectomy. One case, G. W., a doctor, who had infection in both tonsils associated with migraine-like attacks, was temporarily relieved by radiation of the tonsils. However, he had a complete return of his symptoms after six months and it was necessary for him subsequently to have his tonsils removed. Very careful pathological studies of the sections of these removed tonsils following radiation are now being made by Dr. Crowe, head of the Department of Otolaryngology of the Johns Hopkins Hospital. Before making any statement as to the effect of radiation on the tonsillar tissue it will be necessary to have a large number of cases and compare them with a large number of normal tonsils. The cells, germinal centers and crypts must be carefully studied individually. The only definite thing we have noted so far has been the constant appearance of hyperemia. The author had hoped to be able to make a more definite statement in regard to what actually happens to the tonsils after radiation, but this will have to be after a larger number of cases have been treated.

The Results of Tonsillectomy on Acute Rheumatism in Children. The histories of 144 patients who had been in Guy's hospital for acute rheumatism were analyzed by G. H. Hunt and A. A. Osman.[8] Enucleation of the tonsils was performed in 66 instances, and in 35 (53 per cent.) there were recurrences.

Among the 78 patients not operated on, there were recurrences in 33 (42 per cent.). Among 96 patients admitted to the hospital for a first attack of acute rheumatism, there were 40 per cent. recurrences. The tonsils were enucleated in 50 of these patients, with 46 per cent. recurrences; there were recurrences in 33 per cent. of the patients not operated on.

Among 48 patients admitted to the hospital for a second or later attack, there were recurrences in 62.5 per cent. The tonsils were enucleated in 16, with recurrences in 75 per cent.; there were recurrences in 56 per cent. of the 32 patients not operated on.

Enucleation of the tonsils is not a certain preventive of a recurrence of acute rheumatism. In this series recurrences were more frequent in patients subjected to operation. It seems probable that although the tonsils may be the primary focus of infection or portal of entry in the first attack, the infective agent may remain dormant in some other part of the body. The increased frequency of recurrence in patients with cardiac lesions suggests that the persisting focus of infection may sometimes be the heart itself.

Many considerations must influence the question as regards the advisability of tonsillectomy in rheumatic children. There may be local indications of tonsillar

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(8) Guy's Hosp. Rep., October, 1923.

infection with enlargement of the neighboring lymphatic glands. In such cases operation is probably advisable in order to prevent further attacks of tonsillitis, with consequent impairment of the child's general health. The figures do not support the contention that operation in such cases diminishes the liability to rheumatic infection. Clearly, the operation in rheumatic children whose tonsils and lymphatic glands appear healthy is quite unjustifiable.

[The observations expressed here are hardly in accord with our usual clinical observation. Recurrence of rheumatism does take place after the tonsils have been removed, not infrequently after an attack of acute pharyngitis. On the other hand, recurring attacks are most frequently associated with the recurrence of an attack of acute tonsillitis. With the tonsils removed such recurrences are eliminated. It would appear that when an attack of rheumatism follows an acute tonsillitis attack, the logical thing would be to prevent a subsequent attack of tonsil infection by the proper removal of the tonsils.—Ed.]

Effect of Tonsillectomy on the General Health of Twelve Hundred Children. The real value of the tonsil operation can be determined only by repeated examinations of the children before operation, and at stated intervals afterwards. They must be compared with children during the same periods who were not operated on, and in whom the indications for tonsillectomy were the same as in those operated on. Such a study has been made by A. D. Kaiser[9] on 1,200 operated children as compared with an equal number who had not been operated on. The author presents a number of detailed charts and tables, and comes to the following conclusions.

After a review of the data, one can attempt to draw some conclusions as to the value of tonsillectomy, but must not be unmindful of the dangers of the surgical procedure as well as the complications that do occur.

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(9) Jour. Amer. Med. Ass'n., July 5, 1924.

One is at once impressed with the absence of any spectacular results when a group is studied controlled by a group not operated on. The striking improvement that is often witnessed in a child's general health following this operation fails to be so evident in a group in which selection is not made.

The desirability and justification of this operation depend on the ultimate effect on the child. Many years must elapse before the ultimate effect can be determined; but, after a period of three years, a group of 1,200 children operated on compared to an equal number of similar children in whom operation was denied leads one to conclude that:

1. Tonsillectomy offers a child considerable relief from such common complaints as sore throat, head colds and mouth breathing.

2. It lessens the chances of having discharging ears and their complications.

3. It assures some protection against glandular infection, but is no guarantee against it, and it does not assure the immediate disappearance of large cervical glands.

4. It does not influence favorably or unfavorably infections of the larnyx, bronchi and lungs, as they occur equally in the two groups.

5. It does not prevent scarlet fever or measles, but may influence the severity of the infections.

6. It seems to lessen the incidence of diphtheria by removing fertile soil for the diphtheria bacillus.

7. It has not influenced the incidence of chorea or rheumatism.

8. It has shown a lessened incidence of heart disease over a period of three years.

9. It has definitely reduced malnutrition in the group operated on as compared to the group that was not operated on.

MISCELLANEOUS CONDITIONS

Vincent's Angina. The experience of J. H. Hutton[1] leads him to believe that Vincent's angina is not a rare condition. Vincent's infection is due to the spirillum and fusiform bacillus. Bercher contends that the lowering of the resistance of the buccal mucous membrane is the chief and primary cause and that the organisms play a secondary rôle. The resistance may be lowered by: (1) a general infection, such as diabetes or scurvy, or by lead, phosphorus or mercury; (2) the infection accompanying the eruption of wisdom teeth; (3) a trophic disorder of the mucosa due to alveodental irritation.

The symptoms are insomnia, constant drooling of saliva, foul odor to breath, loss of appetite, soreness of the mouth and bleeding from exposed vessels. On examination ulcers are seen, which are covered by a grayish slough. On removing the slough a red hemorrhagic surface is exposed.

In the treatment the author mentions numerous local applications, but advises a mouth wash of sodium perborate, frequently, and the application of 10 per cent. neosalvarsan in glycerin daily, after removing all necrotic debris. The use of the tooth brush should be stopped. The dentist should be consulted in order that the teeth may be placed in the best possible condition. The author also mentions general treatment such as: (1) potassium chlorate, eighteen grains daily; (2) antimony and potassium tartrate, one per cent. solution made up in sterile freshly distilled water and 0.5 c.c. of this solution injected intravenously. The solution should be injected very slowly, and care taken not to get it outside of the vessel.

The author reports a case in which the patient only became well after intravenous injection of massive doses of neoarsphenamine. His belief is that if the drug is given early and intensively it will cure practically every case.

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(1) Med. Jour. and Record, Mar. 19, 1924.

The Use of Sulpharsphenamin in Vincent's Angina and Stomatitis in Children. Because of the difficulty of using the arsphenamins intravenously in children, L. H. Barenberg and M. W. Bloomberg* have treated a series of cases with sulpharsphenamin intramuscularly. Fifteen cases of Vincent's angina were treated, eight by intramuscular injections alone and seven by intramuscular injection combined with local application of sulpharsphenamin three times daily. The dose was 0.1 or 0.2 gm., dissolved in the concentration of 0.1 gm. to 5 minims of distilled water. The average duration of the disease in patients having injections only, was six and one-half days; of those on combined treatment, about four days.

Twenty-seven cases of stomatitis were also treated. Of these, nineteen were typical cases of ulcero-membranous gingivitis. Some were treated by the simple intramuscular injections, others, by the combined treatment. The results show that in the former group the lesions healed in about one week, in the latter, in about five days. In some instances pyorrhea alveolaris also responded to the treatment. The authors conclude by saying that one or two intramuscular injections usually produce a cure, and that no local or general reactions were encountered.

Retro-pharyngeal Abscess; and Erosion of Internal Carotid Artery; Pathological Specimen. This interesting case is reported by D. E. S. Wishart.[2] The author reviews the anatomy of the region involved and gives several horizontal cross-sections cut through at the level of the tonsil and hard palate. He states that the retropharyngeal lymph nodes are arranged in four groups,

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(*) Jour. Amer. Med. Ass'n., July 5, 1924.

(2) Can. Med. Ass'n. Jour., September, 1923.

two on each side of the mid-line. Their general arrangement is vertical. The lateral group is found median to the internal carotid and is described as more constant than the medial group which lies in the retro-pharyngeal space closer to the mid-line. Both groups receive some afferent lymphatic vessels from the accessory nasal sinuses, the nasal fossae, the naso-pharynx, and pharynx, and send efferent vessels to the internal jugular group

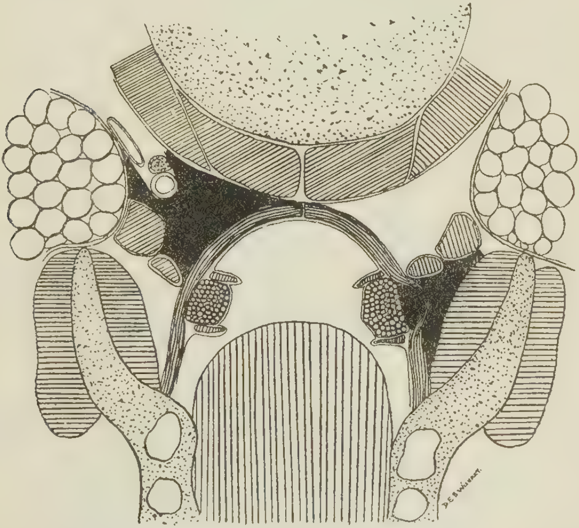


Fig. 19.

of the posterior deep cervical chain. Fairly constant in the first years of life these lymph-nodes rapidly undergo retrogression, so that whereas ten or more may be found in the infant there will rarely be found more than one in the entire retro-pharyngeal space of the adult.

Figure 19 is diagrammatic, but a close approximation to the exact anatomy is shown by cross sections, and is the result of the author's observations while studying this region under the instruction of Dr. H. P.

Mosher, who has been prominent in emphasizing the importance of the pharyngo-maxillary fossa. The advantages of this representation are as follows: it shows that the large vessels lie in the center of the space: it emphasizes the fact that the lateral extension of an abscess would show as a bulge under the lower edge of the parotid in the upper part of the neck: and it demonstrates how a peritonsillar abscess will tend to locate in the pterygoid compartment of the pharyngo-maxillary fossa and have difficulty in extending either to the carotid sheath or to the retro-pharyngeal space proper.

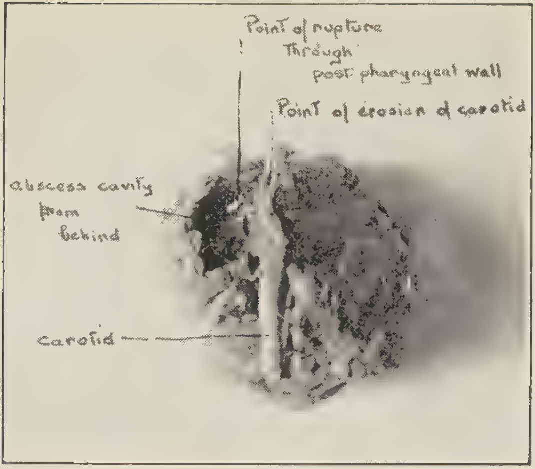
Further the diagram indicates the structures penetrated by the incision into a retro-pharyngeal abscess, which are: 1, the pharyngeal mucosa; 2, the pharyngeal aponeurosis; 3, the superior constrictor muscle; 4, the bucco-pharyngeal fascia; 5, the loose areolar tissue of the retro-pharyngeal space.

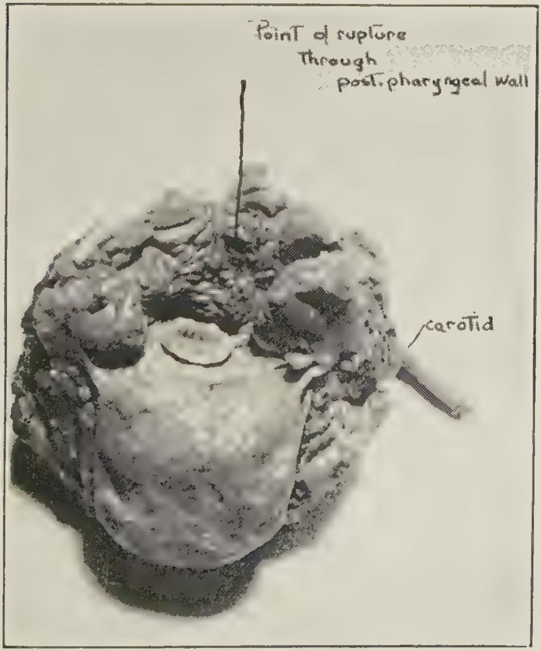
The median raphe of the pharynx has been emphasized. The superior constrictor muscle has been represented by lines parallel to the pharynx to indicate that the fibres of the muscle are more horizontal in their course than they are perpendicular.

Etiology. Theoretically, suppuration may occur in the tissues between the mucous membrane of the posterior wall of the pharynx and the spine, as the result of 1, injury to the posterior wall of the pharynx from blows or foreign bodies; 2, the burrowing of pus from other regions; 3, caries of the spine; and 4, suppuration in the retro-pharyngeal lymph-nodes.

Pathology. The process is essentially first an adenitis, then a periadenitis, and finally a breaking down with suppuration and the formation of an abscess. In twenty-six cases the abscess was described as unilateral; in only a few cases was it noted that the abscess extended especially downward. In no case did it extend much above the level of the soft palate, so that it may be concluded that the majority were confined to the oro-pharyngeal region.

PLATE XLII.


Point of rupture
Through
post pharyngeal wall
Point of erosion of carotid
abscess cavity
from
behind
carotid


Point of rupture
Through
post. pharyngeal wall
carotid

Erosion of internal carotid artery.—Wishart, page 430.

Symptoms. It is manifest that the condition is essentially one of infancy. The onset is, therefore, obscure, and dependence for history has to be placed upon parents who are frequently poor observers. Careful tabulation shows that by far the most frequent causes for the anxiety of the parents were: (1) that the child was breathing or swallowing with difficulty and, (2) the appearance of swelling on one side of the neck.

Diagnosis. Marked swelling of the cervical glands, and the presence of a pharyngeal swelling should lead to the consideration of the probability of a retro-pharyngeal abscess.

However, having determined the presence of a fluctuating swelling the physician must endeavor to rule out several possibilities before he diagnosis the condition under discussion here. Tuberculous disease of the vertical spine is rare but must be considered if there is history of rigidity of the neck of long standing, or if the child holds its head in its hands. In such a case it will be apparent that treatment can be delayed long enough to procure an *x*-ray photograph of the neck. Aneurysm of the carotid will be excluded by the absence of pulsation. In spinal osteomyelitis the symptoms will be very acute with high fever.

If, on the other hand, there be swelling but no fluctuation the possibility must be considered of lymphadenitis of the retro-pharyngeal nodes without the formation of pus, or of an acute pharyngitis in the throats of patients suffering from cervical scoliosis.

Treatment. Many and various are the methods enumerated in the texts, for the procedure to be followed in the surgical treatment of this condition. The procedure to be described is that followed and taught by the laryngological service of the Hospital for Sick Children.

A case of retro-pharyngeal abscess is always to be considered an emergency, to be admitted at once for immediate evacuation of the abscess, and to be given constant supervision until out of danger. The operation is to be considered dangerous but at the same time safe if it is properly performed.

No anesthetic is necessary. The child is swathed, placed on its back on a table, and a mouth gag inserted. The assistant stands behind the child's head, holds it between his two hands, and turns the head so that the abscess is on the lower side. Under inspection by reflected light the tongue is depressed by a suitable tongue depressor held by the surgeon in his left hand. The surgeon then takes in his right hand a pair of special pointed tonsil scissors, which he passes closed into the child's mouth until they touch the apex of the pharyngeal swelling. The scissors are plunged through the mucosa and the superior constrictor muscle covering the swelling, and opened wide so as to make a vertical slit and pulled out while still widely open.

All this is but the work of a few seconds. The important part of the operation is to follow. It consists in the attendant at once rolling the child on its side while the surgeon with the tongue depressor holds the tongue down and the cheek open so that the pus unable to find its way into the trachea and larynx flows freely out of the mouth. No local after-treatment is necessary.

The above procedure sounds, and in good hands looks, very simple; but the student, being taught an operation he may have to perform as an emergency, is cautioned that he must know what he is going to do, must be able to see where he is working, and must do what is to be done quickly. A child with this condition may easily and rapidly die if the operator bungle his job.

The case reported by the author is that of a baby, E. B., 18 months old, who was perfectly well until three weeks prior to being seen, when a patchy sore throat developed. Two weeks later a swelling in the side of the neck appeared which was fomented and went down gradually. The child was playing about on the day before admission. On the morning of the day of admission it had a sudden hemorrhage from the mouth and lost about a bowlful of fairly dark clotted blood; and in the evening about seven o'clock had a similar hemorrhage of about a cupful of blood of a brighter red color and more fluid. The signs of exsanguination were then very marked, the mucous membranes being almost white.

The child was brought to hospital for transfusion about eleven o'clock that night, was extremely anemic and died within two minutes of reaching the admitting room. As the child had not been examined, a clinical diagnosis of hemorrhage, probably gastric, was made, but the autopsy revealed the true diagnosis of retro-pharyngeal abscess with erosion of the internal carotid artery.

On dissecting the retro-pharyngeal tissue just to the left of the middle line of the pharynx there was found an abscess cavity which would hold about a drachm of fluid and which contained dark red clots. It had spread into the pharynx just to the left of the mid-line by an opening one-half centimetre in diameter. The wall of the internal carotid artery was eroded for a distance of about two centimetres and lay on the posterior wall of the cavity. The tissues about the cavity were red and boggy. (Plate XLII.)

A section made of the tonsil on the side of the abscess showed no inflammatory change. The muscle wall of the tonsillar fossa was intact and thick. The abscess was, therefore, definitely retro-pharyngeal and not peritonsillar, and had extended laterally in the posterior compartment of the pharyngo-maxillary space and involved the internal carotid artery.

The Direct Vision Adenotome for the Removal of Adenoids. The technic of adenoid removal with the direct vision adenotome is given in a report by I. D. Kelly, Jr.[3] Under local or general anesthesia the mouth is widely opened with a gag, the instrument is inserted, the posterior portion of the tongue is depressed with the

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(3) Jour. Missouri State Med. Ass'n., December, 1923.

undersurface of the hood until the free margin of the soft palate is seen above the upper surface of the instrument. The instrument is then gently pushed back to the posterior wall and the distal or hood end is raised into the naso-pharynx, the small ridge on the edge of the upper hood surface automatically engaging the soft palate border, and forcing it forward on the surface of the hood out of harm's way. The distal end of the instrument is further raised into the nasal vault until the adenoid is seen to be completely surrounded. The instrument is then firmly pressed against the posterior wall, and the blade pushed closed by means of the thumb plate and the adenoid is completely severed from its attachment. When the instrument is removed the adenoid will be found inside the hood.

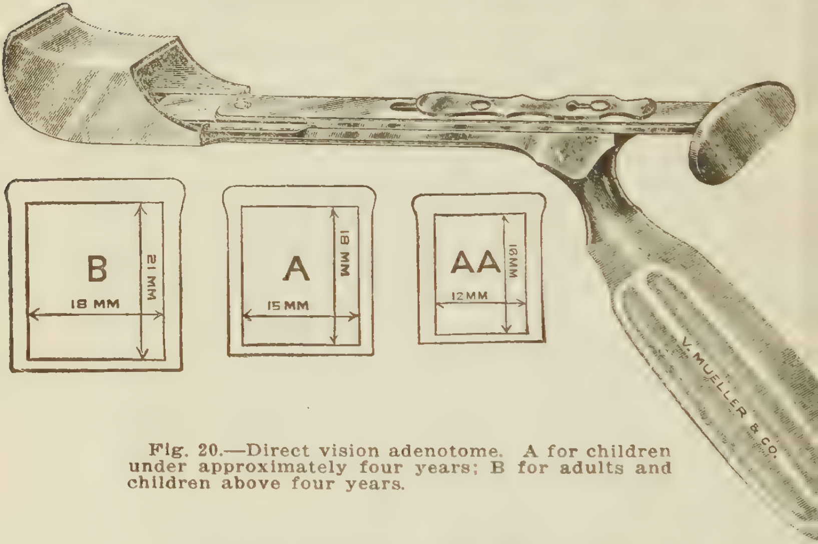

Fig. 20.—Direct vision adenotome. A for children under approximately four years; B for adults and children above four years.

Indications for the direct vision operation are found in all cases where a complete surgical removal is desired. There are no contraindications to its use. Occasionally deep depressions on the posterior wall above the second cervical vertebra can not be reached. To remove adenoid tissue here it is necessary to use a narrow curette or biting forceps which can best be done under direct vision through the adenotome. To avoid leaving portions of adenoid tissue in the vault of the pharynx it is important to reach the vault with the instrument, to surround the adenoid completely and to watch carefully during the cutting process. Where both the tonsils and adenoids are to be removed it is advised to remove the adenoids first because the field of operation is then unobscured by blood from the tonsil region. An important feature of the adenotome is that it permits a study of the adenoid before and during removal, and also, if no adenoid be present, prevents useless curretting by exposing the smooth glistening mucous membrane to the direct view of the operator. The adenotome consists of a hollow shaft or hood, which permits direct vision and serves as a soft palate retractor, the distal or blade end of which when put into position conforms to and rests directly against the posterior naso-pharyngeal wall. A hand grip extends from the proximal end of the shank and is placed at such an angle as to prevent chin or chest interference when gripped and placed in position. On the upper surface of the shank is a shaft to which is attached a flexible blade traversing the cutting surface at the distal end of the hood from below upwards, thus permitting adenectomy under the vision of the surgeon.

Clinical Course and Etiology of Postanginous Septic Diseases. Six cases of septic disease following angina are reported by Reye.[4] In some of these cases the clinical picture was very severe from the onset, while others seemed at first to be harmless anginas, and only gradually developed the severe signs of sepsis. All patients showed a very high and generally continuous fever, and in three cases there were chills. It was characteristic of all the cases that the fever did not stop with the healing of the tonsils.

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(4) Virchow's Arch. f. path. Anat., Sept. 28, 1923.

The changes in the pharynx were similar to those of diphtheria, but diphtheria bacilli were never found. At the time of death, from 8 to 32 days after commencement of the disease, the symptoms in the pharynx had generally disappeared except for a slight swelling of the tonsils.

In all six cases autopsy revealed the source of the septic disease as a thrombophlebitis in the region of the pathologic focus. In three cases a thrombophlebitis of the jugular vein had been demonstrated clinically, and in one case there was a thrombophlebitis of the anterior facial vein extending to the point where it emptied into the jugular. In one case autopsy showed a thrombophlebitis of the palatine vein that had not been recognized clinically. In thrombosis of the jugular vein and its branches, edema and a swelling at the angle of the jaw were found.

The author states that he often thought he could palpate thrombosed veins to the middle of the sternocleidomastoid muscle, yet confusion with inflamed edemas or gland swellings is possible. In three cases in which thrombosis of the jugular was diagnosed, ligation of the jugular was undertaken. This was unsuccessful, because in two cases there was already metastatic suppuration in the lungs and other organs.

The author thinks that the operation should not be delayed until the diagnosis of thrombophlebitis is definitely made, but the vein should be ligated if, in spite of the retrogression of the local process, the fever remains high and the swelling and sensitiveness on pressure persists at the angle of the jaw.

In two cases anaërobic streptoccoci were demonstrated as the cause of the disease. These cases had a slow course (20 and 23 days). In one instance streptoccocus putridus and pneumococcus were found together (duration 6 days), in another, aërobic streptococci (duration 10 days) was noted. Aërobic staphylococci (duration 10 days) was found in one case and in the sixth case the bacillus bifidus was determined to be the cause of death.

Acute Septic Pharyngolaryngitis. S. G. Dabney[5] says that in this condition the onset is usually sudden, frequently with a chill, and the temperature is elevated and subject often to marked septic fluctuation. Many authors describe intense pain, especially in the lateral region of the pharynx. All agree that in the severer forms of pharyngeal involvement there is noted a great swelling of the pharynx, with dark red congestion, edema of the uvula, epiglottis and aryepiglottic folds with alarming dyspnea.

The chief danger is from violent septic poisoning. Deglutition is usually difficult. In some cases cervical cellulitis may be the most marked symptom. The course is often rapid; death may occur in twelve hours, or the patient may recover in a few days.

In mild cases the internal treatment consists of a calomel purge, codein, and aspirin. Locally an ice-bag to the neck, and astringent applications to the throat are beneficial. Hot saline irrigation is every effective if there is much secretion and difficulty is encountered in removing it. The author accomplishes this irrigation with a fountain syringe, the tip being placed well back of the base of the tongue.

Where edema of the larynx is present, the closest observation should be kept, and if it interferes with breathing the patient should not be left until the condition is relieved. Scarification of the epiglottis and aryepiglottic folds, if done early, and repeated as necessary, may obviate the necessity of a tracheotomy. The author has used antistreptococcic serum in one case, with rapid recovery of the patient. Stimulants (whisky or brandy, and strychnia) and nourishing food are necessary in all cases.

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(5) Kentucky Med. Jour., January, 1924.

DISEASES OF THE ESOPHAGUS

Practical Points in the Management of Pharyngo-Esophageal Diverticula. The diverticulum, according to P. P. Vinson,[6] always leads from the porterior portion of the pharyngo-esophageal wall. Hence, when an attempt is made to introduce an esophagoscope or sound into the esophagus, it readily passes into the blind pouch instead. By careful manipulation with the esophagoscope, the opening into the esophagus, which is at the upper end of the sac, may be identified and the instrument passed beyond the diverticulum.

If the patient gradually swallows 5 yards of twisted silk during the period of 24 hours, the thread will easily pass through the esophagus into the stomach and finally into the intestines. By pulling on the thread hanging from the mouth, an ordinary sound may be easily passed beyond the diverticulum and into the esophagus.

With the thread lax, the sound is first passed to the bottom of the diverticulum. The lax thread is then pulled taut, causing the staff to pull out of the mouth for a distance equal to the depth of the sac. The sound will then be at the opening into the esophagus, into which it can be passed with ease by holding the thread taut. Since diverticulum is the only esophageal lesion in which these results will be observed, this procedure is a distinct aid in differential diagnosis.

The larger the sac, the greater the difficulty is in locating the opening into the esophagus with the esophagoscope. A catheter may be passed into the esophagus over the guiding thread and nourishment administered, so that the general condition will improve, and the risk from operation be greatly reduced.

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(6) Colorado Med., January, 1924.

Lye Strictures of the Esophagus. During the past year R. McKinney[7] has seen 14 of these cases, 12 occurring in children. The history is similar in nearly all of the cases. The patient has no difficulty in swallowing for a varying interval of time, the primary burn having healed. Later, a progressive increase in difficulty in deglutition occurs. Suddenly, several months or a year perhaps after the lye was swallowed, there is esophageal stenosis, complete or nearly so. This is due to cicatricial contraction.

Contrary to what might be expected, the author has found the sites of stenosis were frequently located in the lower third of the esophagus, and often at two or more localities. This may be explained by the voluntary relaxation of the constrictor muscles at the upper end of the esophagus, when the walls are irritated by the lye, allowing the solution then to pass uninterruptedly down into the esophagus.

Most of the patients brought for consultation have a small opening through the stricture, perhaps thread-like in size, and never adequate for proper nourishment. If an opening can be traced the problem of treatment is not so difficult, but if there is a complete stenosis a gastrostomy should be done immediately, for water hunger may bring death before the problem of dilatation can be worked out. No time should then be lost in endeavoring to dilate the stricture. However, no case is on record where a gastrostomy has been done in early childhood and nourishment thus continued with survival of the patient to advanced adult life.

Gradual dilatation avoids the danger of rupturing the esophagus. This is done, after a preliminary fluoroscopy, through a Jackson or Bruening esophagoscope, using preferably Jackson's flexible linen bougies, gradually increasing the size. No anesthetic is used with children, but sometimes in adults a 10 per cent. solution of cocain

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(7) Jour. Tennessee State Med. Ass'n., November, 1923.

is applied to the hypopharynx. The string swallowing procedure, to find an opening through an apparently impermeable stricture, is occasionally used, but with very young children there is always difficulty in preventing their biting the thread in two, even when introduced through the nose.

The author says that it is of greatest importance that bougienage should be begun promptly, and continued over a long period of time, even though there is no appreciable obstruction. Only in this way can we often prevent miserable existence or a fatal outcome.

Four Open Safety-Pins in the Esophagus. This case, reported by Chevalier Jackson[8] presented several unusual difficulties.

A boy, aged 9 months, was referred to Drs. Cornelius Coakley and W. F. Cunningham, with the history that on admission to the Southampton Hospital for a phimosis operation an open safety-pin had been found in the stools by the nurse. The mother stated that an older child had put a safety-pin in the patient's mouth. Roentgen-ray examination was promptly made for other safety-pins, and four, all open and all of a very large size, were found lodged in the esophagus. They had probably been present for nearly two months. (Plate XLIII.)

Esophagoscopy revealed that the pins were interlocked so that when the point of one was brought into the esophagoscopic tube-mouth, traction could not safely be made because all the pins were dragged on, which would have caused the other three points to perforate. With the help of Dr. Willis F. Manges, it was discovered that the Gordian knot could be untied (not cut) by disentangling the two lower pins downward, one at a time. These two smaller pins were carefully guided under direct vision into the stomach, with the gastroscope. The

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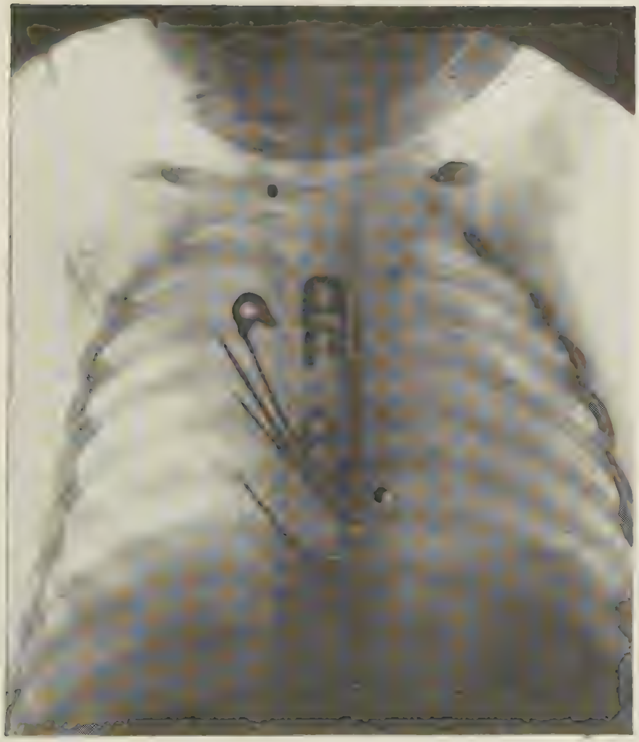
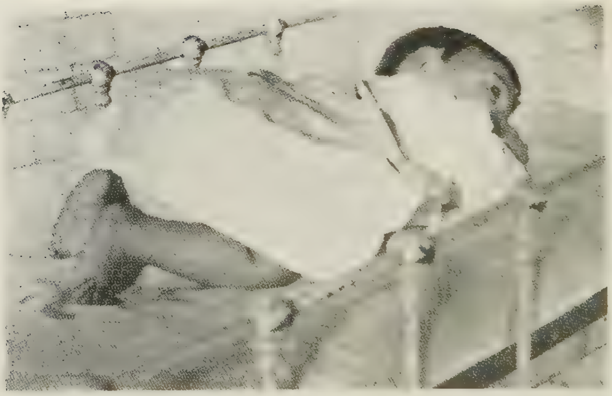
(8) Jour. Amer. Med. Ass n., Sept. 29, 1923.

PLATE XLIII.



Four large, stiff, interlocked safety-pins impacted in the esophagus of a child, aged 9 months.—Jackson, page 442.

PLATE XLIV.



Prone position, preference for which has been frequently noted as a symptom of foreign body in the esophagus.—Jackson, page 442.

two remaining very large and very stiff pins were removed through the mouth by the esophagoscopic, point-protected method of the author, the Tucker forceps being employed.

It was intended to remove the other two pins from the stomach through the mouth, with the gastroscope at a subsequent sitting, but an unusually large pylorus permitted them to pass into the intestinal tract, and they passed out safely with the stools.

The patient was discharged cured.

Apart from the mechanical problem of the interlocked pins, the case is interesting as beautifully illustrating a heretofore unrecorded symptom of esophageal foreign body in children, first noted by Miss Frances Grove, R. N., and since so often seen at the Bronchoscopic Clinic in other cases as to preclude mere coincidence. The symptom consists in the preference for lying in the prone position. After the pins were out, the child preferred the dorsal position. (Plate XLIV.)

As a matter of prophylaxis, safety-pins should be kept out of the reach of children, and parents and nurses should not set a bad example by holding the pins in their own mouths while dressing children.

Foreign Bodies in the Esophagus and Their Complications. According to W. Tesar,[9] foreign bodies ordinarily lodge at points in the esophagus which are physiologically narrow—behind the lamina of the cricoid cartilage, at the level of the bifurcation of the trachea and the aortic arch, and at the esophageal opening of the diaphragm.

Among the pathologic constrictions the author mentions: (1) congenital stenoses, permeable only for fluids; (there is considerable dilatation above them); (2) cicatricial stenoses from corrosion, burns, diphtheritic or syphilitic ulcers, scarlet fever, tuberculosis, typhoid, which are generally multiple, and are located in the cervical part of the esophagus or at the level of the

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(9) Prakticky lek., Jan. 1, 1924.

cardia; (3) stenoses caused by benign or malignant tumors; (4) compression stenoses, very rare, and usually diagnosed only on autopsy; (5) spastic stenoses as a result of swallowing foreign bodies.

Cases of foreign body should be sent immediately to the specialist. No attempt at extraction should be made, on account of the dangers. Sounding has no value in diagnosis, and an attempt to push the foreign body down into the stomach by means of an instrument is extremely dangerous. The foreign body should be removed by a specialist with the aid of the esophagoscope, preceded by careful *x*-ray examination. Esophagotomy should be undertaken only after esophagoscopy has completely failed.

Among the complications of foreign bodies the author mentions chronic esophagitis, injuries of the esophageal mucous membrane (danger of mediastinitis), perisophageal abscess, necrotic ulcers (danger of an esophagotracheal fistula), and diverticulum formation with pressure ulcers of the esophageal wall (phlegmons, rupture into the mediastinum). A number of these complications end in death. The majority are caused by dangerous manipulations with the sound, or extraction without control of the eye. The diagnosis and extraction of foreign bodies from the esophagus is the surest and least dangerous for the patient when the esophagoscope is used.

Radium Therapy in Cancer of the Esophagus. J. Guisez[1] reports cases which showed well developed tumors and which had existed for some time before treatment was begun. In the author's technic a long sound is fixed to the teeth which maintains the tubes exactly in place. Several tubes are used in order that the entire tumor may be irradiated. In no case has a burn or ulceration of healthy tissue been noted.

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(1) Bull. d'oto-rhino-laryngol., November, 1923.

In patients with almost complete dysphagia, deglutition has been rendered normal, and there has been complete disappearance of the tumor as far as can be determined by esophagoscopy. Although formerly the results were only palliative, curative results have become more and more frequent in recent years, so that it would seem that if the rules for radium treatment of cancer can be exactly fixed, it will be possible to attack and cure with certainty the majority of cases. While cancer of the esophagus is considered particularly susceptible to treatment, the technic of application is delicate and must be submitted to precise rules, otherwise the results will be negative or lead to excitation of the growth.

Treatment of Carcinoma of the Esophagus with Radium. According to T. E. Carmody,[2] more than 50 per cent of pathology found in the walls of the esophagus, present carcinomatous change.

Under etiology the author mentions: Irritants such as tobacco, spicy foods, hot liquids, and alcohol; cardiospasm, of short or of many years duration; male sex being involved much more frequently than the female sex; and the fifth decade being the years of greatest incidence.

Symptoms. Pain is rare except in lesions of the upper third of the esophagus. Dysphasia, with or without regurgitation, is practically always present as the most prominent symptom. Dilatation is frequent according to the author. Severe hemorrhage is rare, although slight streaking with blood is frequently noted when the upper portion of the esophagus is involved. The great majority of patients give a history of increasing difficulty in swallowing which is painless and fairly rapid in its progress.

Diagnosis. The diagnosis is often apparent from the symptoms, age and history, but should be corroborated

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(2) Laryngoscope, February, 1924.

by x-ray, esophagoscopy, and biopsy, in the order named. Aneurysm of the aorta and abscess in the mediastinum should be excluded by x-ray before passing the tube. Biopsy is important as absolute proof but is not necessary if the endoscopist is experienced. The heaped-up cauliflower appearance of the carcinomatous ulcer is not easily mistaken for an ulcer produced by the tubercle bacillus or the spirochete. Also, the odor from the cancerous tissue is quite characteristic.

Treatment. Operations, although they may be brilliant, have been successful in such a small number of cases, and must overcome such great obstancles that they are not practicable. Roentgen-ray has retarded growth and relieved pain in some cases and should be used as an adjunct even when radium is employed. It has the advantage that it penetrates much farther than radium and affects the peri-esophageal structure and glands.

The application of radium has been made directly to the growth from within, either by placing it under direct vision through the esophagoscope, by means of a stylet of wire or rubber tube, or by allowing the patient to swallow the tube with a thread or flexible wire attached. Vinson's appartus is also used, with a bougie above and below the tube. Needles may be introduced into the growth, or radium seeds planted within the carcinomatous tissue. In both of these external application is made use of to cross-fire. The author favors the direct vision application, using needles or the seeds. Of course, there is the danger of perforation. The screens used are either a half to one millimeter of silver or brass, covered by one-half to one millimeter of pure gum rubber.

The author has treated six cases in the past year and one-half. Two are reported as improved, three have died, and one, while holding weight, shows a definite recurrence.

Post-Diphtheritic Laryngeal Stenosis. J. H. Foster[3] thinks that the fact that the great majority of these cases have been intubated has led many to attribute the stenosis either to injury inflicted in the act of intubation or to the effect of pressure of the tube. In consequence they advocate tracheotomy as a safer procedure. Investigation indicates that permanent tube cases were as common in pre-intubation days as now. They would probably have been much more common, since antitoxin was not used, but for the fact that death claimed the severe, sloughing cases. Jackson says:

"Diphtheria is essentially a necrotic process that with or without intubation is apt to leave cicatricial stenosis and, in the writer's experience, stenosis has followed tracheotomy about as frequently as intubation."

It is unquestionably true that an unskillfully performed emergency high tracheotomy is apt to cause a very serious cicatricial stenosis. To a certain extent the same may be said of the wearing of an improperly fitting tracheotomy tube.

These cases usually come under observation as a result of their inability to dispense with their intubation or tracheotomy tubes. A careful examination must be made to determine the cause. This suggestion may seem superfluous, but many disappointments are due to attempts to handle all cases of laryngeal stenosis routinely, instead of first ascertaining as nearly as possible the pathological condition present and adapting the treatment to it.

A certain number of apparently severe cases will show upon examination no organic stricture. These are classi-

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(3) Southern Med. Jour., January, 1924.

fied by Jackson as panic and spasmodic types. An examination will reveal the nature of this trouble and obviate the steps necessary to relieve a more severe type.

Where the stenosis is due to actual mechanical obstruction it may result from edema, hyperplasia, cicatrix or from a combination of these. Some of the worst looking cases one encounters are those early ones where supraglottic edema and hyperplasia have apparently followed pressure of the head of the intubation tube. Large masses appear which markedly obstruct breathing. The infraglottic type of hypertrophy appears as a thickening of the lining of the larynx which may be strictly bilateral or extend completely around the larynx. Cicatricial stenosis may appear in the form of bands across the larynx, adhesion of the cords, or as a circular, or funnel-shaped stricture. The cicatricial type is a more or less terminal stage, having been almost necessarily preceded by an inflammatory hyperplastic condition.

In the severe panic and spasmodic cases a tracheotomy is necessary in order to dispense with the intubation tube. The trachea tube can be removed after gradually stopping it up more and more and accustoming the patient to breathing through the natural passages. In the majority of cases, however, if one gains the confidence of the child and works patiently, the intubation tube can eventually be removed without tracheotomy.

The edematous and milder hyperplastic cases may be relieved by tracheotomy alone. With the establishment of breathing through the tracheotomy tube, the larynx is given a complete rest and the inflammation subsides. Where the hyperplasia is marked the application of the actual cautery or of trichloracetic acid to the masses has a marked effect in causing shrinkage. Surgical removal is rarely indicated. During the process of healing, periodic gradual dilatation prevents adhesions and deters cicatricial contraction. The results in these cases are usually excellent.

Where one encounters a case of marked cicatricial stenosis one has something that may tax one's resources to the utmost. When we consider that in diphtheria the ulcerative process preceding the cicatrix is superficial and that the framework of the larynx is not involved, it seems that the cases requiring laryngostomy should be very infrequent. Dilatatory intubation gives splendid results in certain adult cases of cicatricial stenosis, but all of the post-diphtheritic laryngeal stenosis cases encountered by the author have been in young children, and their larynges do not well tolerate prolonged pressure.

What procedure, then, should we adopt? In the first place it goes without saying that every case should wear a tracheotomy tube. One is taking an unjustifiable risk in working on such a case without a tracheotomy tube in place.

If the stenosis is complete it is necessary to incise the stricture and perhaps remove some of the tissue with punch forceps. The application of trichloracetic acid to the raw edges prevents adhesions. An opening having been gained, we then begin systematic, gradual dilatation of the stricture with bougies under direct inspection. For a time it appears that no progress is made. The opening seems to close up as badly as ever between treatments. This may cause the error of attempting to hasten matters by more drastic measures. Patient persistence, however, will soon be rewarded by a patent larynx, the opening gradually retaining more nearly each time that attained by the bougie.

As the lumen of the larynx enlarges the patient should be encouraged to breathe through it more and more by stopping up the tracheotomy tube, at first only during the day and later all the time. Do not be in a hurry to remove the tube. The parents always want it out just as soon as they find that the child can get along with it stopped up for a few days. It is much better to keep the tube in six months longer than absolutely necessary than to risk a sudden death.

When finally it is deemed safe to remove the tube the child should be seen from time to time. We are all familiar with the tendency of strictures to recur and patients should be warned of this. Unfortunately this often is of no avail. As long as the child gets along without trouble they will not bring it back, especially if they live at a distance.

Acute Catarrhal Laryngitis. Since acute catarrhal laryngitis is short in duration, often mild in character, and tends towards spontaneous recovery, H. G. Beatty[4] thinks we too often pass over it lightly.

The commoner predisposing causes to chronicity, of acute catarrhal laryngitis, are:

1. Method of breathing, such as mouth-breathing.
2. Impaired general health.
3. Occupation, such as singing, speaking auctioneering.
4. Sex, age and season. Men constitute the greater number of these cases, and as a rule, more cases occur in the spring months than at any other time. The exciting causes are:

1. Secondary to inflammation higher up.
2. Exposure.
3. Excessive or improper use of the voice.
4. Chemicals.

Symptoms. Of the patients seeking treatment for a condition which we term acute catarrhal laryngitis, the greater percentage come complaining of husky voice. This is natural since the function of the organ is impaired. The symptom next frequently complained of is irritation, which results in various forms of discomfort, pain, or cough, or all three. There is rarely obstructed respiration in simple acute catarrhal laryngitis. With the exception of a few cases, such as

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(4) Ohio State Med. Jour., March, 1924.

hysteria, neurasthenia, or an unusually emotional patient, the basis of the complaint is the quality and extent of the involvement.

Types of affection. Early simple, acute, active congestion usually gives rise to more discomfort and irritation than any other stage of the simpler forms. Here the intrinsic laryngeal structures and trachea have unnaturally dry surfaces, breathing is attended with more or less discomfort, and phonation is impaired and may be painful. Cough, if present, is usually painful.

If the attack is milder and the greatest changes are limited to the true cords and this condition be more an edema than a congestion, the voice will be impaired out of proportion to the discomfort. If, however, the exciting cause has been sufficient to cause a more general edema involving the arytenoids and false cords, as well as the true cords, then the discomfort and voice impairment will be increased. If the attack is severe and the hyperemia sufficient to color the cords deep red, the discomfort and impairment of function may be great. In fact, in these cases the hyperemic and edematous false cords may almost entirely obscure from view the true cords even when in the phonation position. These patients often have a feeling of constriction within the larynx and more or less anxiety regarding breathing, seldom, however, resulting in actual dyspnea. If there is a tendency to the formation of large crusts of dry mucus and exfoliated cells, actual obstruction may occur and such patients should be kept under closer observation than those of other classes. In these latter two types aphonia is the rule, rather than simply a "hoarse voice."

Treatment of acute laryngitis. Acute catarrhal laryngitis probably gets less consideration in the hands of the average rhinologist than any similar inflammation in other parts of the upper respiratory tract. Acute rhinitis, pharyngitis, et cetera, receive diversified systems of treatment, depending on the clinic or doctor, but often the best the larynx gets is what "splashes over" from above. Or, if it is treated, all stages of the affection are treated similarly and not much attention given the larynx unless the condition assumes alarming proportions or the patient complains severely.

Needless to say, the changes in the laryngeal structures should be carefully noted if for no other reason than to differentiate our diagnosed acute catarrhal laryngitis from other more serious affairs in their early stages.

Medication is introduced into the larynx in the form of vapor, fluid or powder. Too often the vapor or heavy spray is the one prepared for the treatment of the nose or throat and includes the larynx regardless of the actual condition of this organ. This is not conscientious, nor even humane, treatment.

It is of course true that the laryngeal inflammation accompanies tonsillitis, pharyngitis or rhino-pharyngitis, but we must remember that the tonsillar inflammation is *usually* a reaction to septic crypt contents, and the rhinitis is often at least intensified by sinus or surface infection, while septic laryngitis is not common.

The larynx stands as the last outpost and guard for our lower respiratory tract, protecting it from invasion by the various constituents of bad air, bacteria and foreign substances. It is subjected frequently to our use and abuse in giving impression to varying mental stages produced by excitement or stimulation and often under conditions unfavorable to its proper working. Surely such a loyal fellow deserves our careful consideration when out of order. The remarkable fact is that we do not have more frequent complaints from this structure. Truly is this so when we consider how many times the upper structures fail almost completely, through faulty formation or infection, to do their share of the work, or even hinder the larynx in doing so.

Some patients, whose occupations do not require much use of the voice, disregard a mild laryngeal change until it becomes intensified or other acute disturbance brings them to us. As they may date their trouble from this latter period, we must be on guard lest we have to deal with an affection actually older than the usual three- to ten-day period. Therefore, before diagnosis is made, or treatment begun, we must carefully seek the possible existing causes, both predisposing and exciting. Then and only then can rational advice and treatment be given.

In the treatment of acute catarrhal laryngitis the cotton applicator and the old-time glass jar nebulizers with the stock solution are very much out of place. Acutely inflamed laryngeal structures should receive gentle and careful treatment. An increase in the congestion can easily be produced by rough ''swabbing'' and by the injudicious use of strong astringents or irritants. Whether the laryngitis is a mild, or severe active congestion, whether it is more edematous in character, or whether it involves one or several laryngeal structures, these diagnoses must be made, then the treatment directed as indicated.

We have had satisfying results by using, among other forms of treatment, some of the medications in the form of a rather dense, finely divided vapor. This is accomplished through the use of a floor apparatus using air at about sixty pounds pressure and emitting a gentle, constant flow of the vapor. In this way we can make application direct to the parts without trauma. The medication is selected and mixed for each individual treatment. In this way we get the prompt effect of a sedative, stimulant or astringent.

For more severe congestion the use of steam vapor bearing the proper proportion of mild alkalies and some preparation like tincture of benzoin gives a great deal of relief. Here probably the heat is of the greatest therapeutic value. Constitutional treatment, removal from bad hygienic surroundings and air conditions, general and voice rest need only be mentioned to be recognized as important.

Hemangioma of the Larynx. Fourteen cases of hemangioma of the larynx are reported by R. Kramer and S. Yankauer*. Hemangioma is a benign tumor originating from blood-vessels. There are two types, the simple and the cavernous; the former is a new growth of blood-vessels, the walls of which are more or less parallel with one another in the long axis of the vessel. The latter is made up of irregular shaped, comparatively large blood spaces. In the histologic examination one must differentiate these from varix, submucous hemorrhage, mixed growths, vascular granulation tissue, and vascular malignant growths.

The etiology of the condition is unknown; the majority of investigators have leaned toward belief in a congenital origin. All the patients of the authors were adults between 30 and 50 years of age. That some irritation in the larynx may be the causal factor must be borne in mind. The subjective symptoms are hoarseness, dyspnea, stridor, suffocation, cyanosis, croupy cough, various forms of parasthesia, dysphagia, vomiting, and bloody expectoration. The laryngoscopic appearances are rather varied; the typical picture is a small pedunculated or sessile reddish growth situated on the anterior half of a vocal cord in a man complaining of hoarseness. There is a much rarer type occurring in infants in which the predominant feature is respiratory distress. A circular subglottic diffuse growth is usually found.

One of the symptoms of the greatest diagnostic value is the appearance of the tumor on respiration and phonation; on phonation the tumor becomes erect, smaller, and firmer, and the color takes on a deeper hue. Lesions from which hemangiomas must be differentiated are simple and specific granulomas, cysts, fibromas, varixes, submucous hemorrhages, and vascular malignant tumors.

(*) Laryngoscope, June, 1924.

There have been many methods of treatment but the present day practice has narrowed the field down to two types of procedure, surgery, or irradiation with radium and *x*-rays. The authors believe that all of the smaller tumors should be operated on by means of forceps or snare, under direct or indirect laryngoscopy. Large tumors are best attacked by suspension laryngoscopy and sharp dissection. In none of the cases reported was immediate or postoperative hemorrhage present.

Tuberculosis of the Larynx. Interesting data in regard to tuberculosis of the larynx has been reported by H. H. Briggs[5]. The frequency of the condition is shown in the report of the Iowa State Sanatorium for the year ending July, 1919. Of over two thousand cases of pulmonary tuberculosis, 25 per cent. showed laryngeal involvement. Of 322 incipient cases, 10 per cent. had laryngeal involvement, while 722 cases of moderately advanced pulmonary tuberculosis showed 21 per cent. and 693 advanced cases showed 42 per cent. In the moderately advanced cases the laryngeal process was arrested in 16 per cent., improved in 48 per cent. and unimproved in 33 per cent. In the advanced cases the larynx was arrested in 18 per cent., improved in 17 per cent. and unimproved in 64 per cent. In some instances the larynx improved, the lungs remaining unimproved, and *vice versa.*

In another group of cases it was found that males and females were affected in about equal ratio. Also the percentage of cases showing unimproved larynges was highest between the ages of 40 and 50, namely, 72 per cent. Cases of incipient tuberculosis showed 64 per cent. improvement, being twice as high as in cases of moderate involvement. A very important finding is that the mortality in the first year of incipient pulmonary tuberculosis is three times as great as that found in the same type without laryngeal involvement.

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(5) Southern Med. Jour., September, 1923.

The author feels that there are no distinctly pathognomonic symptoms in the incipient stages. They do not differ at first from that of simple chronic laryngitis. Dysphagia is a most constant symptom in advanced cases, but may or may not occur in the early stages.

Early infiltration of the epiglottis causes great pain, while involvement of the cords and posterior commissure is usually accompanied by a lesser degree of pain. Hoarseness and aphonia may not appear until the later stages. Stridor is manifest at the onset of stenosis, which may be caused by edema, granulomata or tuberculomata.

The main essential in the treatment is a well selected regime. Each case should be treated individually. As in pulmonary tuberculosis, the cardinal points of treatment are rest, including regulated exercise, nourishment, air, and sunshine. While the lung involvement may be mild, serious results may follow if the patient does not follow the regime strictly. Rest of the voice is very essential and is really the most valuable measure in the cure. Pain and dysphagia may be relieved by various means, depending on the case. Orthoform insufflation, cocaine or procain, chaulmoogra oil, bland menthol-eucolyptol oil solution, or electric cautery, may be used. Injection or resection of the superior laryngeal nerve brings relief when other measures fail. Frequently, the use of too strong a topical application, especially in acute cases, and lack of care in carrying out the technic results in much damage to the larynx and in extension of the tuberculosis process. In every tuberculosis sanatorium a skilled laryngologist should be in attendance so that these patients may be given aid as early as possible.

Chaulmoogra Oil in the Treatment of Laryngeal Tuberculosis. Observations on Its Local and Constitutional Effects. I. D. Bronfin and C. Markel[6] report fifty cases of pulmonary tuberculosis, and with laryngeal

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(6) Amer. Rev. Tuberc., November, 1923.

tuberculosis of various degrees, which were treated with chaulmoogra oil. Of these, 43 received the local treatment with the oil itself, while in 7 cases the ethyl esters of the oil, ''chaulmestrol,'' were used.

The average length of treatment was a little over 4 months. The average amount administered to each patient was 20 c.c. of the oil, or 18 c.c. of the chaulmestrol. The length of clinical observation averaged 12 months in the 43 cases, and 10 months in the 7 cases.

The results showed no difference in the action of the two drugs. Neither the aggravation of local symptoms reported by Peers and Shipman, nor the improvement observed by Lukens, and by Alloway and Lebenson, was confirmed. The symptoms were unaffected in 56 per cent., aggravated in 23 per cent., and improved in 21 per cent. of cases. Complete relief from pain was noted in only 2 instances, and from dysphagia in 1 instance. These 3 cases were of the chronic type. In 12 cases increased local ulceration was noted.

Of 20 progressive cases, 16 per cent. were improved, and 44 per cent. remained stationary. Progressive pulmonary cases continued to progress, while stationary pulmonary lesions remained unchanged. In no instance did the cough diminish or the expectoration become less tenacious in character. Neither clinical nor roentgenologic examination produced satisfactory evidence of new or recent pnuemonic consolidation, or new areas of infiltration such as could have been caused by aspiration.

The Treatment of Rhino-Laryngological Tuberculosis by Finsen Light Baths, and Results. O. Strandberg[7] states that nine years ago he first reported results on treatment of laryngeal tuberculosis by the Finsen light.

The method. The Finsen bath consists mainly of an electrical carbon light which is supplied in two sizes, a small one and one somewhat larger. The small one is used for the treatment of more serious cases, who cannot bear to sit up—for instance, patients with tuberculosis

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(7) Lancet, Dec. 8, 1923.

of the larynx, or patients recently operated on for tuberlosis of the ear. It consists of a system of three electric carbon arc lamps, which are connected either in parallel or in series, the latter, however, only when using a current of 220 volts which will then require a series resistance of 55 volts. The lamps are suspended from the ceiling and have check-rods in a perpendicular plane to prevent the lamps from rotary movement. Two patients, each on his own couch, can be treated simultaneously by this type of Finsen bath. The couch must be as close to the light as possible. The lamps use 20 amperes and 55 volts each. The distance between the light arcs is 550 mm.

With regard to the large Finsen bath, six to eight patients can be treated at the same time, sitting round two large electric carbon arc lamps, each of 75 amperes and 55 volts. The distance between the light arcs of the two lamps is 600 mm. The carbon-electrodes of the lamps are situated perpendicular to each other, the positive being fitted uppermost, because if direct current is used a crater will be formed in the positive electrode, and from this crater the greater part of the effective rays is radiated. With alternating current, on the contrary, the light-cone is emitted from the upper and the lower carbon-electrode alternately, and hence, so much effective chemical light is lost that alternating current cannot be used, without first being converted into direct current. No glass or other covering round the light should be used, as the chemical rays would then be absorbed. The lamps must burn with a clear, steady light, and the carbon-electrodes must not be allowed to glow or to soot up. It is evident that the large lamps generate a larger amount of chemical light than the small ones, but this difference is neutralized by the fact that the patients cannot sit as close to the large lamps as they can lie near to the small ones, because the latter give off less heat than the large ones, and it is of importance that it should be possible to place the patients closer to the light of the small lamps, because the intensity of the light decreases with the square of the distance. On account of the strong light the faces and the eyes of the patients are protected by a paper shade, but otherwise they are completely naked. They must be placed as near to the light as they can bear the heat, and they must turn round occasionally in order that the light may be equally distributed all over the body. When using the large lamps of 75 amperes, a room with a cubic capacity of 90 to 100 m. and with a floor area of 5 by 4.8 metres will be necessary. With the three small lamps, a cubic capacity of 75 to 80 m. and a floor area of 5.5 by 3.5 metres will be sufficient.

The indications. Patients with tuberculosis of the larynx or those who are seriously ill or feverish, lie in the Finsen bath the first few days from 10 to 15 minutes, slowly increasing up to the full dose of two and a half hours every alternate day. When they are able to sit up, they may begin with the large lamps, taking a shorter bath the first few times, but they may, of course, continue with the small lamps if more convenient. Patients with other illnesses—for instance, lupus vulgaris, where the state of health in general is good, can well begin with 30 to 45 minutes with the large lamps. After the Finsen bath a tepid shower-bath is always given and the out-patients go home to their work.

It is of little importance whether a bath is given every day or only every other day. After the first baths one will find on the body an erythema of varying strength, ranging from an intense blush to the formation of vescicles. In a short time the patients will be brown pigmented, as if sunburnt, and from then onwards will feel no further inconvenience from the Finsen bath. It might be expected that patients who walk during the cold season of the year straight from a Finsen bath to their work would be more disposed to colds, but the author's observations would seem to show the contrary.

Contra-indications are shown only in certain heart and kidney troubles—*i. e.*, provided that the latter are not of tuberculous origin. When treating lupus vulgaris, the author always combines the Finsen bath with surgical treatment or electrocoagulation simultaneously. This is also done in many cases of tuberculosis of the larynx.

Results. The following results were obtained in 100 patients in whom the lesions of the larynx was not that of the ordinary laryngitis, but an infiltrative or ulcerative affection, which occurs among patients with pulmonary tuberculosis.

100 Patients with Tuberculosis of Larynx
Before Treatment

Hoarseness.	Pain and difficulty in swallowing.	T. B. in sputum.	Tuberc. of Lungs	Hæmoptysis
97	37	80	100	8

After Treatment

The voice.		Pain and difficulty in swallowing.		Hæmoptysis during treatment.
Clear	78	Cured	32	2, both having had hæmoptysis before treatment.
Improved	15	Improved	3	
Unchanged	4	Unchanged	2	

100 Patients with Tubercuosis of Larynx
77 out-patients; 23 in-patients

Cured in larynx	Still under treatment	Lapsed cases				
			Improved	19		
53	10	37	Unchanged	6	Improved	3
	all improved		Aggravated	6	Unchanged	1
			Died	6	Aggravated	2

Periods of Observation of 53 Patients Cured of Tuberculosis of Larynx

Light baths, 34 cases. Light baths + surgical treatment, 19.

0–3 ms.	3–6 ms.	6–12 ms.	12–18 ms.	18–24 ms.	2–3 yrs.	3–4 yrs.	4–5 yrs.
22	5	8	2	4	7	3	2

Recurrence: 3
Still under treatment, 2
Re-cured and without recurrence in one year, 1

Fifty-three per cent. of cures of tuberculosis of the larynx is a very large percentage. But the treatment has later been thoroughly tested in other hospitals also; in the Oresunds Hospital for Tuberculosis at Copenhagen Blegvad cured some 30 per cent. of the 110 in-patients. Affections of the larynx which the author has treated were often in a very advanced stage. No doubt the percentage of cures might be greatly increased in patients with less advanced lesions and treated in an earlier stage.

Early Diagnosis and Treatment of Malignant Disease of the Larynx. The clinical classification of malignant disease is important because the location and extent of the lesion determines the treatment, and to a large extent the life of the patient. According to F. O. Lewis[8] the best classification divides the lesions into intrinsic, extrinsic, and the mixed types.

Intrinsic cancer fortunately occurs more frequently than extrinsic and usually involves the vocal cords. It develops slowly, does not extend rapidly, and metastasizes late, due to the confined arrangement of the laryngeal lymphatic system. There are abundant lymphatics within the larynx which communicate with only a small gland on each side of the larynx. No direct communication with the general lymphatic system exists. Proper operative measures are therefore successful in the intrinsic type of laryngeal cancer. In the extrinsic type the course is rapid, the glands are inovlved early, metastasis occurs rapidly, and operative procedures are much less hopeful.

Eighty per cent. of cures may be expected if proper surgical treatment is instituted early. The signs and symptoms are usually few and varied. Hoarseness is practically the only early symptom if the lesion is located on the vocal cord. No severe symptoms may be produced at all if the lesion is situated on the aryepiglottic fold. All cases of hoarseness lasting more than a few weeks should be looked upon with suspicion. This is especially true after the age of forty.

Cancer of the larynx may easily be confounded with tuberculosis, syphilis, chronic laryngitis, perichondrites, pachydermia and benign growths. A one-sided ulcerating lesion, with lessened cord mobility, is very suggestive

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(8) Atlantic Med. Jour., September, 1923.

of malignancy. The early immobility of the cricoarytenoid joint from infiltration is a distinguishing feature. Pain on swallowing which radiates to the ear is a late symptom in the intrinsic form, but may be present early if the lesion is located on the aryepiglottic folds. The appearance of a lesion is not diagnostic and may often be misleading. A biopsy should be obtained in all cases if possible.

The most successful treatment in operable cases is surgery. The methods used are endolaryngeal excision, thyrotomy, partial laryngectomy and total laryngectomy. Endolaryngeal excision is indicated where the lesion is confined to a very small area. Thyrotomy is successful in cases of intrinsic cancer in which it is possible to excise the growth and also some of the adjacent normal tissue. Partial laryngectomy is seldom employed because of the high mortality. Total laryngectomy is indicated in all cases of intrinsic cancer in which thyrotomy is contraindicated, extrinsic cancer in which there is no evidence of mediastinal metastasis, and in those cases in which the patient's general condition is sufficient to warrant such an operation. The author reports seven cases of total extirpation of the larynx. Four are living, the longest period since the operation is one year. Radium is successful only as a preoperative and postoperative measure.

Notes on Fourteen Cases of Intrinsic Cancer of the Larynx, With Lantern Demonstration of the Pathological Anatomy. Of 14 cases reported by J. S. Fraser and D. Watson,[9] 6 were private, and 8 were hospital cases, The cases were seen between the years 1916 and 1922. Only 2 of the patients were females. The ages varied from 36 to 76 years. The oldest patient made a good recovery and is alive and well 4 years after the operation. The youngest, a man of 36, died of recurrence of the growth.

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(9) Jour. Laryngol. and Otol., February, 1924.

The main symptom was hoarseness. More or less pain was complained of by the patients, and dyspnea was present in the bilateral case. The right cord was involved in 10 of the cases. The affected cord showed more or less mobility in 8 instances. The diagnosis seldom presents any difficulty by the indirect method, but a piece of the tissue was removed in every case where the patient consented, by the direct method with Pfau's double cutting forceps. In no case was an attempt made by endolaryngeal methods to remove the tumor.

A summary of the 14 cases shows that 7 patients recovered, and 7 died. Of those recovering, 1 patient who was alive and well 7 years after the operation died, in 1923, of cervical cancer. One patient is well 6 years after operation, 2 at a period of 4 years, 2 at 2 years, and 1 at a period of 1 year after operation. Of the 7 fatal cases, 1 patient died of apoplexy, 3 of pulmonary complication, and 3 of recurrence of local disease.

The author concludes that thyrotomy is a suitable operation for the cure of cancer of the larynx in a comparatively small group of cases. Patients suffering from marked arteriosclerosis, from pulmonary affections, or from syphilis should not be operated on. Thyrotomy is only indicated if the growth on the vocal cord is a limited one—if it does not transgress the anterior commissure or reach the vocal process, and if the cord itself is fairly movable. Laryngectomy is indicated when the process has extended deeply, and the cord is almost immobile. All patients, and especially those over 40, who have a hoarseness lasting more than a few days, should have a laryngeal examination.

The Operative Treatment of Cancer of the Larynx. J. T. Mackenty[1] gives statistics as to the results obtained by him in this field during the past 20 years. It is a question whether extrinsic cancer of the larynx will ever

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(1) Jour. Laryngol. and Otol., February, 1924.

be amenable to surgery. Since 1917 the author has undertaken only one such case and it ended in death from recurrence.

Prior to 1916-17, of 6 hemilaryngectomies, 2 resulted in ultimate cures. Of 13 total laryngectomies during the period prior to 1916-17, there was no recurrence in 6 cases. Between 1906 and 1920, 20 thyrotomies were performed. In 8 of these the growth was removed, leaving the cartilaginous walls. In 7 recurrence ended in death. A window resection in 12 cases was followed by a cure in 4 cases. A subsequent total laryngectomy performed in 3 of the recurrent cases failed to stay the disease.

Between 1917 and 1922 the author saw 143 cases of laryngeal cancer, 46 of which were intrinsic and gave some hope of cure. In 31 out of the 46 intrinsic cases total laryngectomy was performed, and in 2, thyrotomy. No surgical mortality occurred in the series of 31 cases. Twenty-nine were done by the one-stage operation; 2 by the two-stage operation. Twenty-five patients have entirely discarded the tracheal canula. Of the 33 intrinsic cases operated, 2 were in women. Twenty-six of the 33 patients are still alive, with no evidence of recurrence. Of the remaining 7, 1 died of pneumonia at 84 years of age; 1 died of cerebral hemorrhage 2 years after operation; 1 of recurrence; and 4 of extension of the process. Fourteen out of 18 show no recurrence after a period of 4-5 years.

The author states that if 5 more of the series should succumb to cancer, making in all 10 cancer deaths in 33 cases, there would still be over 66 per cent. cured, a result quite worth the effort. Between September, 1922, and July, 1923, 44 cases of cancer of the larynx were seen. Twenty-two of these appeared intrinsic, and 18 submitted to laryngectomy.

The series, taken altogether, includes 88 operations of all types—thyrotomy, hemilaryngectomy, and total laryngectomy. The surgical mortality has been practically *nil,* only two diabetic patients succumbing to operation. Special attention is called to the high percentage of recurrence in all but the total laryngectomies, and to the recurrence of the disease in all the extrinsic and many of the late, apparently intrinsic cases.

The author describes his technic of laryngectomy in detail. After the operation the patients wear a bulging wire screen over the tracheal opening. This is covered by a high soft collar, allowing the patient to breathe warmed air even when out in the cold. More or less function of the voice is noted in these cases. One patient was able to whisper by exhaling air through the esophagus which had been swallowed into the stomach.

The author concludes by emphasizing that incipient intrinsic cancer of the larynx is a very hopeful disease and that the laryngectomized patient is not a surgical curiosity, but a useful, active citizen, capable of continuing his life's work.

Malignant Neoplasms of the Pharynx and Larynx. Surgery, Radium and Radiotherapy. A series of cases are reported by Sargnon[2] which allow the drawing of a parallel between the results by radium alone, *x*-ray alone, and by a combination of these two. Only a single case of neoplasm of the inferior pharynx was observed in three years, and it resulted in cure. The case was that of retrocrico-arytenoidal spindle-cell epithelioma, treated by laryngo-fissure and the application of radium in the interior of the growth for twenty-four hours.

In the intrinsic laryngeal cancers, whether extrinsic from the start, or becoming so, the prognosis is grave. Not one of the author's cases was cured. Most cases showed temporary improvement, followed by recurrence that could not be arrested. The prognosis of intrinsic cancers of the larynx is much better. When the intrinsic form is already diffuse, especially in the posterior wall of the larynx, laryngo-fissure is used, combined with

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(2) Arch. internat. de laryngol., November, 1923.

radium and x-rays. The author remains faithful to laryngo-fissure, followed by the application of radium, and then x-rays, at first through the open wound and then through the skin. In 7 cases during the past year there is no recurrence, even in the cases in which the cords were resected. In spite of deep roentgenotherapy the author has returned to the conception of conservative surgery, combined with radium and x-ray.

For the inferior pharynx, pharyngolaryngectomy is no longer done, but applications of radium are used, internally and externally, and deep roentgenotherapy, or a combination of the two. For extrinsic, and extensive intrinsic pharyngolaryngeal cancers, the author employs tracheotomy, followed by radium, internally and externally, combined with deep roentgenotherapy. In the localized forms laryngo-fissure is performed, and following this, x-ray applied. Weaker doses of radium are used, but for a longer time and more filtered, adding aluminum layers and a large thickness of gauze to the platinum or gold filter.

Some Observations on Laryngo-Fissure and Its Technic. Laryngo-fissure, perhaps better termed thyrotomy, inasmuch as in the majority of cases the thyroid cartilage alone is divided, is an operation which, for the cure of intrinsic malignant disease of the larynx, has passed through many phases. F. H. Diggle[3] states that Gurdon Buck, of New York, in 1851, was the first surgeon to perform this operation for malignant disease. In 1864 Duncan Gibb successfully performed laryngo-fissure for a case of epithelioma. The patient survived twelve months before recurrence took place. Morell Mackenzie, in 1873, published the results of laryngo-fissure in 48 cases, 7 of which were malignant. Operative mortality was 8.3 per cent.: recurrence took place in 22.9 per cent., while freedom from recurrence only occurred in 14.5 per cent. Paul Bruns, in 1878, published results showing that the operation for malignant disease was com-

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(3) Practitioner, November, 1923.

pletely unsatisfactory and worthless. The operation fell into disuse as a result of these statistics, but came into favor again between 1880 and 1894. During this period the percentage of cures increased to 50 per cent. From then until the present time the cures have varied from 52 to 80 per cent.

In no other organ of the body can such good operative results be shown for malignant disease. A brief review of the lymph-vascular system will show this. The lymphatic network of the interior of the larynx is divided by the true vocal cords into two more or less distinct areas, that above them and that below. Posteriorly in the arytenoid region these communicate. The collecting trunks of the upper area pass to the digastric gland, the glands on the bifurcation of the carotid, and to glands in the deep cervical chain. The lower area is collected anteriorly to the prelaryngeal gland and also below the cricoid cartilage to the supraclavicular chain of glands. Growths from the true vocal cords, consequently, tend to spread towards the superior aperture of the larynx, while infraglottic growths spread along the trachea. Glandular involvement is a very late incidence. Any extension of the growth posteriorly or upwards, with involvement of the aryteno-epiglottidean fold renders the operation unsuitable. Its greatest utility is in cases of pure cordal growth, and it is gratifying to know that about 50 per cent. of intralaryngeal growths are cordal in origin.

Aspiration of blood during the operation can be prevented by a proper tamponnage of the trachea above the tracheotomy tube through which the anesthetic is administered. After performing a median tracheotomy, a tethered sterile marine sponge should be passed into the upper segment of the trachea before inserting the tracheotomy tube. After the thyroid cartilage has been split, additional safety can be added by packing one-inch ribbon-gauze through the thyrotomy opening down on to the sponge. Bleeding, difficult to control, may arise during subperichondrial separation of the growth from the thyroid ala. To avoid this it is best to ligate the superior laryngeal artery above the thyroid cartilage just before it pierces the thyro hyoid membrane. By prolonging the usual median incision upwards and outwards along the body and greater cornu of the thyroid bone the vessel can be found passing under the thyro hyoid muscle. To combat sepsis the mouth and teeth should be as clean as possible. Extra cloth and gauze packing protect the edges of the skin incision and cellular tissues of the neck. The flow of saliva and mucous can be prevented by the preoperative administration of atropine, the use of chloroform as the general anesthetic, and by having sandbags under the shoulders and neck to arch the laryngo-tracheal axis.

The Directoscop of Häslinger (Vienna) in the Diagnosis and Surgery of the Larnyx. The directoscop of Häslinger seems to S. Israel[4] to be the ideal instrument for endoscopic exposure of the larynx. It is a self-retaining apparatus on the principle of a bivalve speculum and composing a tongue spatula, pharyngeal spatula, and a hypo-pharyngeal plate. (Plates XLV, XLVI.)

At the distal end of the pharyngeal spatula is attached a movable metal plate for the hypopharynx. This plate is self-adjustable and controlled by means of two rods, which allow the plate to be pushed forward and pulled backward at the proper time to effect complete exposure. The metal plate is, by a spring connection, self-adjustable after being placed in position. After the instrument is properly introduced, the exposure of the larynx is controlled by means of a wing bolt, which causes the tongue spatula and pharynx spatula to be opened or closed at will, with either the right or left hand. The handle of the instrument is adjustable to a metal post, either above or below, so that it can be conveniently manipulated, depending upon whether the patient is in an upright or recumbent position. The principle of this

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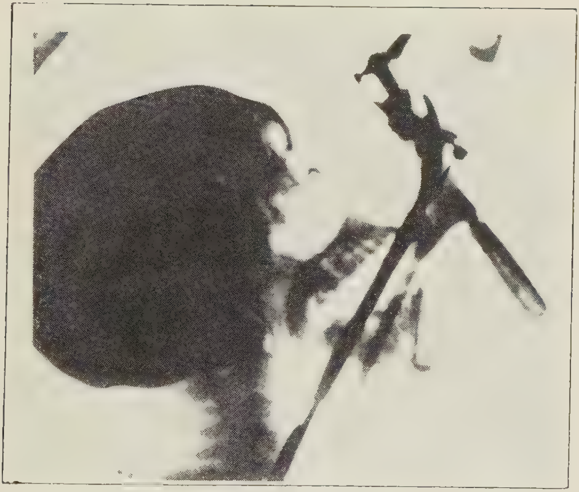
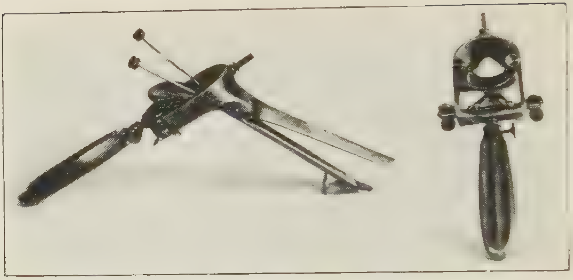
(4) Laryngoscope, December, 1923.

PLATE XLV.



X-ray photograph of the directoscop in place, in the sitting position, exposing the larynx completely.—Israel, page 468.

PLATE XLVI.



Showing instrument with the tongue and pharyngeal spatula slightly separated. The hypo-pharyngeal plate is pushed forward slightly.—Israel, page 468.

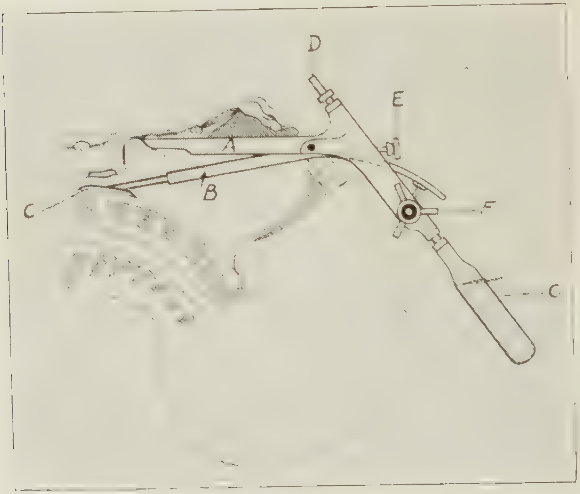


Diagram showing instrument in place in the recumbent position, and relationship of the hypo-pharynx plate to the cervical vertebrae. The distal end of the spatula holds the epiglottis, so that complete view of the larynx is obtained. A—Tongue spatula; B—Pharynx spatula; C—Hypo-pharynx plate; D—Metal post for attachment of handle or light; E—Metal rod for pushing forward or withdrawing hypo-pharynx plate; F—Wing bolt for controlling the spread or opening of the tongue and pharynx spatulae; G—Handle.—Israel, page 468.

instrument for exposure of the larynx differs from other instruments heretofore utilized for this purpose, in that the hypo-pharynx and the underlying vertebræ are used as a fixed point from which counter-pressure is produced to advance the tongue and epiglottis forward, thereby exposing the larynx.

The author states that local anesthesia is usually sufficient, except in young children. The position of the patient may be either upright or recumbent. There is no gallows necessary, nor is it necessary to suspend the patient by the lower jaw. There is no pain, nor do the patients complain of post-examinational discomfort. There is an entire absence of shock, and the instrument can be kept in place over a long period without producing distress.

When the instrument is in place, its position remains fixed and both hands are free to carry out any surgical procedure required. With the exposure afforded by this instrument, cysts have been dissected from the pharyngo-epiglottic fold, papillomas removed from the region of the anterior commissure beneath the vocal cords, cauterization of tuberculous lesions carried out, and a thorough examination of the entire larynx afforded under direct view.

BRONCHOSCOPY AND ESOPHAGOSCOPY

Bronchoscopy and Esophagoscopy. The day is here, according to W. W. Pearson,[5] when one cannot, with justice to himself and to the general public, pose as an expert in this work without the start secured from instruction by one of its leaders, such as Dr. Jackson.

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(5) Jour. Iowa State Med. Soc., October, 1923.

This must be followed up by constant practice on the cadaver, manikin and the dog. The purchase of a set of instruments and the attempt to use them without such instruction is certainly criminal practice. Expert knowledge, in many cases, is required to diagnose the exact location of a foreign body in the chest. Along with auscultation and percussion, the radiograph is of much assistance. The localization of a foreign body in a bronchus which does not cast a shadow with the latter requires a great deal of skill.

Anesthesia, local or general, will depend largely upon the individual operator. No anesthesia is necessary in infants and young children, for diagnostic purposes and for the removal of foreign bodies. Many operators prefer the application of local anesthesia in older children and adults before the introduction of the tubes. A general anesthetic is sometimes indicated in the extraction of large, sharp foreign bodies, in very excitable or hysterical patients, and in patients where there is a stricture to dilate which involves a complex mechanical problem. In the presence of extreme dyspnea the aid of the accessory respiratory muscles in keeping up respiration is most seriously impaired by deep anesthesia.

When a local anesthesia, such as cocaine, is used either in the pharynx, larynx, or low down in the chest, the addition of adrenalin serves a good purpose.

The bronchoscope and the esophagoscope have aided not alone in the removal of foreign bodies from the passages but have opened up a new help to diagnosis of anomalies and diseases along these tracts. Among the conditions which may be studied successfully are mentioned bronchitis, bronchiectasis, catarrh of the trachea, tracheal ozena, bronchial asthma, tuberculosis and luetic lesions, and benign and malignant tumors. Diagnosis of pressure on the passages may be made in such conditions as enlarged thyroid, hyperplasia of the thymus, abscess cavities, enlarged bronchial glands, aneurisms, and mediastinal tumors.

To anyone who is desirous of taking up this line of work the author gives several suggestions.

1. Thorough knowledge of the anatomy and physiology of this region is necessary.
2. Thorough familiarity with the different instruments to be employed, not overlooking the importance of sterilization as for any surgical procedure is necessary.
3. Before operation is attempted all means that assist in the localization of a foreign body should be employed.
4. When possible a duplicate of the foreign body should be carefully examined with a view to determine complications in its removal.
5. The instruments best adapted for the grasping and removal of the foreign body should be selected with the greatest care in each individual case.
6. Pathological processes of this region should be well known to the operator.
7. Gentleness at all times must be uppermost in the mind of the operator.
8. The embarrassment which might result from cessation of breathing must be anticipated, and means for overcoming it must be at hand, such as (a) tracheotomy set; (b) oxygen tank with the tube, which may be attached to the arm of the Jackson bronchoscope for immediate use; (c) amylnitrate; (d) use of the tube in respiratory failure with artificial respiration.
9. Let no man think he is a born operator in this line of work and let him realize that, if he practices every day for five years he will be a much more skillful and successful operator than if he has practiced daily but for two years.
10. The operator must at all times have under perfect control his mental and physical faculties.

Bronchoscopic Observations on the Cough Reflex in Tonsillectomy Under General Anesthesia. The cough reflex is perhaps the least understood factor in tonsillectomy under general anesthesia. It is generally accepted that a light anesthesia and the presence of the laryngeal reflex insures a cough. However, during a recent bronchoscopic study, M. C. Myerson[6] observed that coughing was absent in cases which were lightly anesthetized. A study of the cough was therefore undertaken in a series of one hundred tonsillectomies in which the laryngeal reflex was present during the operation. The presence of cough was noted during the induction of the anesthesia (ether) and during the operation. A direct laryngoscopy and bronchoscopy were performed in each case immediately after operation, when the pharynx was dry and free from blood.

The tonsillectomy furnishes a pharyngeal content consisting of a mixture of blood, mucus, and saliva. Blood is the greatest part of this mixture. An analysis of the cases in the series showed the following results.

Twenty-two patients coughed during operation. Of these, twenty coughed during the induction of anesthesia. A majority of those who coughed during operation also coughed after operation. Of the twenty-two who coughed during operation, eighteen, or 8.18 per cent., had a clean bronchial tree immediately following operation. Seventy-eight patients did not cough during the induction of anesthesia or during the operation. Six of these, or 7.7 per cent., were found to have a tracheo-bronchial tree clean and free from blood.

Seventy-two patients who did not cough had blood in varying quantity in the tracheo-bronchial tree. Twenty-four patients had a tracheo-bronchial tree clean and free from blood. Of the twenty-four, eighteen coughed and six did not.

The patients who coughed did so for one of three reasons, either because of excessive concentration of ether, or because of a pre-existing catarrhal condition of the tracheo-bronchial tree, or because of contact of an instrument with the larynx.

The author comes to the following conclusions.

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(6) Laryngoscope, January, 1924.

1. Seventy-six of one hundred patients in whom the laryngeal reflex was present had blood in varying quantity in the tracheo-bronchial tree.
2. The laryngeal reflex does not insure the presence of cough when the pharyngeal content comes in contact with the larynx, trachea, or bronchus.
3. The patient, when lightly anesthetized, coughs only in the presence of increased irritability of the respiratory tract.
4. Blood, mixed with mucus and saliva, forms a mixture which does not carry a sufficient stimulus to set the cough reflex in motion.
5. Cough is not the normal mechanism of expulsion in tonsillectomy under light anesthesia.

Foreign Bodies in the Bronchi in Children. The classification of foreign bodies entering the air passages may be made from different points of view. According to H. Dietrich and H. K. Berkley,[7] the simplest, and from a clinical standpoint most important, grouping, is to divide them into (1) inorganic substances and (2) organic substances, and then separate these again according to their radiability, into (1) opaque and (2) non-opaque substances.

Foreign bodies set up more or less reaction depending on their size, shape and chemical composition. A foreign body that does not obstruct drainage from the lung produces less reaction than a foreign body of the same physical and chemical characters but of such a size and shape as to occlude the bronchus completely. Inorganic substances, such as iron and steel, cause only a slight local reaction.

Organic bodies set up a more severe and extensive general inflammation. Bone is an exception to this rule. The most irritating of all substances is the roasted peanut kernel, but other nut kernels, such as the walnut, also cause marked general reactions. The inflammatory process set up by the roasted peanut is so violent and

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(7) **Jour. Amer. Med. Ass'n., October, 1923.**

dangerous to life that it has been described separately under the name of arachidic bronchitus. All of Jackson's cases occurred in children. The younger the child, the more severe the reaction. The pathologic condition produced consists of an edematous, purulent laryngotracheobronchitis, which, if not fatal, results in lung abscess unless the peanut is promptly removed. The symptoms produced are due to swelling of the mucus of the air passages, accumulation of purulent lung secretions, and to absorption of toxins.

The members of the opaque group, represented principally by metallic bodies, are as a rule, easily demonstrated on the roentgenogram. Non-opaque substances may, in rare instances, cast a shadow. Until a few years ago we were forced to depend on the history, symptoms and physical examination to make a diagnosis of a non-opaque foreign body in the bronchi. Now, however, due to the work of Jackson, a proper interpretation of the roentgenogram will help to make and confirm the diagnosis of a non-opaque foreign body.

This recent work is a milestone in the path of diagnosis of foreign bodies. It was formerly assumed that an organic foreign body would act as a ball valve, letting air out but not permitting it to enter, producing thereby a partial atelectasis distal to the foreign body which would increase the density of the shadow on the picture. The facts appear to be exactly the reverse. The three characteristic roentgenographic signs of non-opaque foreign bodies in the bronchi are: (1) increased transparency of the entire affected side; (2) depression of the diaphragm on the affected side, and (3) displacement of the heart and mediastinal structures away from the affected side. These findings are caused by an acute obstructive emphysema due to the fact that, except when the obstruction is complete, a small amount of air passes the foreign body on inspiration, while on expiration none escapes, owing to a contraction of the bronchus with a narrowing of its lumen. Later on, when secretions accumulate, a condition known as drowned lung occurs distal to the point of obstruction, and this is represented by an increased density in the plate.

When a foreign body is suspected all human aids to diagnosis of such a condition must be utilized until a negative result is reached. If the object is of such size or in such a position that it is surrounded by sufficient inflammatory tissue as to be partially obstructive, physical findings may be found, such as diminished expansion, and muffled tympani of the affected side, and diminution or complete abolition of the breath sounds over that portion of the lung supplied by the obstructed bronchus, asthmatoid wheeze, and in some instances an inspiratory retraction of the interspaces is also noted.

The cases offering the greatest difficulty in diagnosis are those in which the foreign body is non-opaque and has not been present sufficiently long to set up signs of acute or chronic inflammation.

The treatment of all cases is removal by bronchoscopy. It is highly important that bronchoscopic clinics be established in all the larger cities where one or two individuals may gain the necessary experience and skill. Dexterity, patience, judgment and mechanical sense need to be developed by frequent opportunity in the use of the bronchoscope.

Suppurative Diseases of the Lung; Bronchoscopic Drainage as an Aid to Treatment by the Internist. Bronchoscopy is indicated in any case of suppuration, for diagnosis. Contra-indications, according to Chevalier Jackson,[8] is the history of recent hemorrhage. The procedure should be delayed until a week or two after blood has disappeared from the sputum.

The series of cases reported by the author are not given in detail, but the following conclusions are drawn.

1. Bronchoscopy for diagnosis is of great assistance in obscure cases, and has often revised the previous clinical diagnosis from tuberculosis to nontuberculous

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(8) Jour. Amer. Acad. Ophth. and Oto-Laryngol., 1923.

suppuration; from abscess to bronchiectasis; from abscess, bronchiectasis, tuberculosis, et cetera, to malignant growth; from pulmonary hemorrhage to rupture of dilated tracheal vessels. Many cases show bronchoscopic revision of the diagnosis in the reverse order of each of the foregoing citations.

2. Bronchoscopic treatment of endobronchial malignancy was attempted only once, and was done with the intention of taking a specimen for diagnosis. The growth was removed entirely and was found to be an endothelioma. Doubtless in malignant disease of the lung, bronchoscopy will be useful only diagnostically, though the direct application of radium is feasible mechanically.

3. Bronchoscopic treatment of tuberculosis will doubtless be limited to cases of periodically obstructed drainage of pus accumulations.

4. In all nontuberculous, nonmalignant, not hopeless cases of lung suppuration, peroral bronchoscopic drainage is worthy of first consideration. Alone or combined with endobronchial bronchoscopic medication, it will benefit most cases and will afford absolute cures in a certain percentage of cases.

5. In a number of cases, not of long standing, the aspiration incident to a diagnostic bronchoscopy has brought the temperature to normal and started the patient on the road to recovery.

6. It would, however, be a most unfortunate error if bronchoscopy, for either diagnosis or treatment, were undertaken by anyone as an independent procedure. These procedures can accomplish their greatest usefulness only when carried out under the observation and guidance of the internist, whose broad viewpoint will determine the suitability of the case, by eliminating those in which external surgery or medical care alone is needed.

7. A number of brilliant results have come in those cases in which the internist has enabled the patient to hold his own, but without any progress toward cure.

In these cases, the addition of bi-weekly bronchoscopic drainage has proved the little addition that has turned the tide in the patient's favor, and thus contributed to a cure.

8. The bronchoscopic means of improving drainage are in the removal of obstructing granulation tissue, the dilatation of stenosed bronchi, and restoration of ciliary action by aspiration of areas of purulent drowned lung.

9. Bronchoscopic treatment of lung suppuration is, in principle, not new, but very old. The only new phase is the development of the instruments and technic to the point where the lung can be drained by the inserting of the bronchoscope through the mouth into the suppurating lung harmlessly, painlessly, without anesthesia, in a minute's time, without hospitalization of the patient.

10. As a rule treatment should be begun as early in the case as possible. In some instances, however, a cure has resulted from bronchoscopic treatment of cases of many years' standing; almost a whole lifetime of over twenty years in two instances.

11. In answer to the frequently asked question, "What cases are suitable for bronchoscopic treatment?" the present state of our knowledge enables us to say, "Any case, not hopeless, in which the internist feels the need of supplementing medical care and treatment with bronchoscopic drainage through the mouth, and any case, not hopeless, in which the surgeon feels that external operation is for any reason inadvisable for the time being."

Intercostal Thoracopuncture for the Removal of Penetrating Projectiles in the Lung. *Aspirated foreign bodies.* All foreign bodies, according to Chevalier Jackson,(9) that have reached the lung by the natural passages can be removed by bronchoscopy through the mouth, with ultimate recovery in about 98 per cent. of the cases.

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(9) Ann. Surg., October, 1923.

Penetrating projectiles lodged in the middle of either lower lobe can also be removed by bronchoscopy through the mouth, if the projectile is not too large in its transverse diameter to permit its lengthwise withdrawal through the main bronchus. Foreign bodies that have penetrated the *mediastinum* can be removed by the bronchoscope or esophagoscope, but the advisability of doing so is open to question. In one such case the author deemed such removal inadvisable because the location of the foreign body below the heart would involve grave risk of rupture of the pericardium, owing to the angle of approach through the mouth. It was removed by Dr. Thomas W. Shallow, approaching through the ribs by thoracotomy, with a perfect result. Penetrating projectiles lodged in the upper lobes, unless in a bronchus, are not readily removable by peroral bronchoscopy.

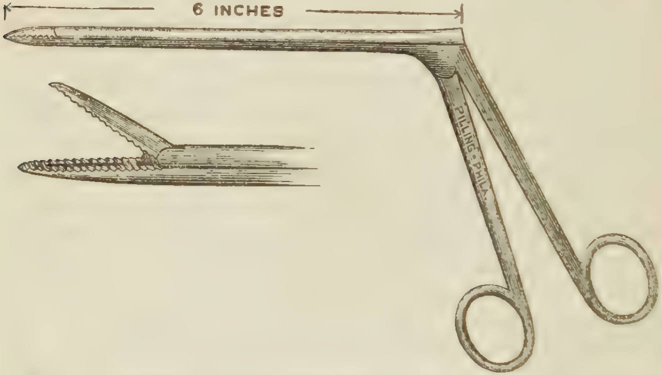


Fig. 21.—Thoracopenetrator with parallel sides, as suggested by Dr. Manges to prevent leakage of air past it into the pleural cavity. Prevention of collapse greatly facilitates reaching and grasping the projectile under fluoroscopic guidan The point is designed to push aside rather than penetrate large vessels or bronchi.

Thoracopuncture for penetrating projectiles. Penetrating projectiles in any portion of either lung can be removed by intercostal thoracopuncture without rib-resection, and in certain cases without pneumothorax, hemothorax, lung suppuration or other complication; but the advisability of the procedure in a given case will doubtless depend upon the size and location of the intruder and upon the presence or absence of suppuration requiring external drainage. A large series of cases will be necessary to make clear the indications and contra-indications of thoracopuncture; but as to its feasibility there can be no question.

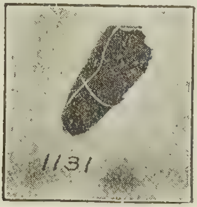


Fig. 22.—Fragment of shrapnel removed through the chest wall by thoracopuncture.

By thoracopuncture is meant the intercostal penetration of the thorax by a special forceps (thoracopenetrator) inserted through the skin, pleura and pulmonary tissue, the instrument fitting its own track so tightly as to avoid open pneumothorax.

The author reports a case of a solider who had a fragment of shrapnel remaining in the chest. With the aid of lung-mapping, and the fluoroscope, the author was able to remove the fragment by thoracopuncture, using the newly devised thoracopenetrator. Recovery of the patient was uneventful.

From his experience the author comes to the following conclusions.

1. The lung-mapping, using bronchoscopic insufflation of bismuth subnitrate, gives efficient aid in the localization of penetrating foreign bodies and their secondary pathology. The insufflation is a harmless procedure. (Plate XLVII.)

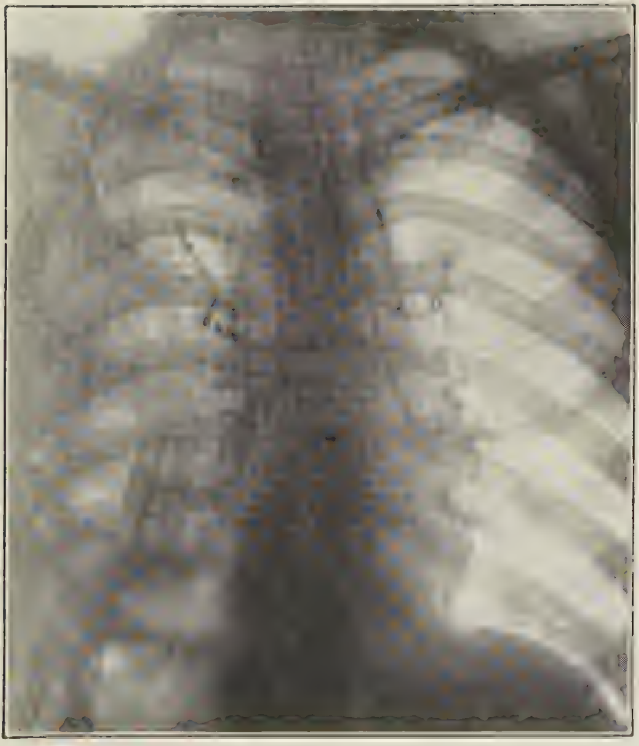
2. The "casing off" of the operative lung, and "piping" the sound lung with a large, close-fitting bronchoscope introduced through the mouth into the bronchus safeguards the thoracic procedure inasmuch as blood can be prevented from entering the sound lung by the bronchoscopic assistant and ventilation may be carried on indefinitely whether the patient's breathing movements are suspended or not.

3. Thoracopuncture, carefully done, with necessary precautions in suitable cases, seems such a minor procedure compared to extensive rib-resection that it promises to modify the adverse opinion held by some surgeons as to the immediate presuppurative removal of small penetrating shell fragments, bullets and other penetrating projectiles lodged in the lung.

4. The author feels sure that any small penetrating projectile not located near the root of the lung can be removed by thoracopuncture under local anesthesia and leave the patient in better condition than if the projectile had gone clear through and emerged without touching a bone or large vessel.

5. Intercostal removal, of course, has the fixed limitation of the maximum available size of the intercostal space. Larger projectiles would require rib-resection. Even in such cases the thoracopenetrator has the great advantage of penetrating the lungs without admitting air to the pleural cavity. Reaching and grasping the projectile under the fluoroscopic guidance are greatly facilitated by the uncollapsed state of the lung. After the intruder is grasped and brought to the ribs, resection may be done, while the projectile is held in the thoracopenetrator. If the intruder is known beforehand to be too large for intercostal removal, the rib-resection may be done first, care being taken not to make a leak through the parietal pleura. The thoracopenetrator will then go in with an air-tight fit.

PLATE XLVII.



Lung-mapping with bronchoscopically insufflated bismuth subcarbonate, showing the relation of the projectile to the tracheobronchial tree. (Film by Dr. Willis F. Manges.)—Jackson, page 477.

6. Thoracopuncture can easily be a very dangerous and rapidly fatal procedure unless the utmost caution is observed in its planning and performance, and in preparedness for possible emergencies. Clawing around in the lung is unnecessary and dangerous. The thoracopenetrator can be inserted, closed, in a safe track, until contact is made with the foreign body; then the jaws can be opened, intruder seized without a single false move and withdrawn through the track of entrance. This track is planned beforehand so that the approach will be through parenchymal lung tissue. Thoracopuncture should not be attempted except by, or with, the coöperation of the thoracic surgeon. The coöperation of an expert roentgenologist with the Manges double-plane fluoroscope is essential for safety as well as success both in the planning and the execution of the procedure. It seems advisable to limit its use to penetrating foreign bodies in the periphery of the lung, avoiding the location of large vessels and the root structures.

7. Thoracopuncture is not advised for the removal of foreign bodies that have reached the lung through the natural passages, 99 per cent. of which can be removed through the mouth.

GENERAL INDEX

Abscess, brain, otitic, 309;
  retropharyngeal, 430
Abscesses, of nasal septum, 347
Accommodation, painful, control of, 59
Acriviolet, use of, 259
Adenoids, tuberculosis of, 405
Adenotome, direct vision, 435
Anesthesia, local, in otology, 252
Anesthetics, general effects of, administered in local tonsillectomy, 398
Angina, Vincent's, 429;
  use of sulpharsphenamin in, 430
Asthma, hay fever, and other manifestations of allergy, 381;
  bronchial, nasal operations in, 391
Auditory canal, external, furunculosis of, 235
Bacteria, from infected teeth, localization in eye, 174
Bacteriologic study, of middle ear infections, 248
Ballenger swivel knife, modification of, 348
Bismuth, in treatment of interstitial keratitis, 85
Blindness, resulting from corneal ulcer, 86
Blood pressure, tinnitus aurium associated with abnormalities of, 244
Bodies, foreign, in bronchi of children, 473
Bronchoscopic observations, on cough reflex in tonsillectomy, 471;
  drainage, in suppurative diseases of the lung, 475
Bronchoscopy, and esophagoscopy, 469
Burns, chemical, of eye, 83
Calcium content of blood, influence of ultraviolet irradiation on, 384
Cancer, of larynx, notes on fourteen cases of, 462;
  of larynx, operative treatment of, 463;
  of tongue, 392;
Carcinoma, of tonsil, deep roentgen and radium therapy in, 415
Cataract, intracapsular extraction, 115;
  medical treatment of, 117
Chalazion, ossification of, 73
Cocain, poisoning, death from, 328
Cold, common, the, 333
Column, ophthalmic, for oculists, 201
Congenital anomalies, 32;
  of eye, and confusion with acquired conditions, 36
Conjunctiva, the, 77
Conjunctivitis, vernal, 77
Cornea, the, 85;
  plana, 32
Corneal microscope, 102
Coryza, acute, human inoculations with nasal secretion in, 334
Cough, paroxysmal, a frequent symptom of infected sinuses, 369;
  reflex, of glossodynia, control through nasal ganglion, 396
Deafness, and hearing, 211;
  and its prevention, 222;
  catarrhal, eustachian injection in treatment of, 216;
  catarrhal, improving the hearing in, 238;
  classification of, 218;

chronic progress, a rhinologic or otologic factor, 226;
in late congenital syphilis, 224;
methods of detecting alleged, 213;
progressive, blue sclerotics with brittle bones associated with, 226;
progressive, endocrine dysfunction as etiology of, 222;
surgical treatment of, 234;
treatment of, 231;
x-ray in treatment of, 228

Diagnosis, eye, 15

Diathermocoagulation, application in rhinolaryngology, 330

Diathermy, surgical, by needle method, 397

Diets, deficient vitamin, as factor in otolaryngological conditions, 361

Diphtheria, primary in ear, 257

Diplopia, spasmodic, 161

Directoscop, of Häslinger, in diagnosis and surgery of larynx, 468

Discharge, chronic aural, 272

Disease, systemic, and tonsillar infection, 406

Diseases, of eye and ear, relationship between, 164;
of mouth, 392;
of nose and accessory sinuses, negative pressure intreatment of, 377;
of throat, 398;
postanginous septic, clinical course and etiology of, 437

Diverticula, pharnygoesophageal, management of, 440

Drowsiness, 24

Ear, pain in, 230;
internal, 313;
middle, bacteriologic studies of infections of, 248;
middle, the, 248;
primary, diphtheria in, 257;
septic, suction in treatment of, 260

Endocrine dysfunction, as etiologic factor in deafness, 222

Epistaxis, leading to diagnosis of scurvy, 352

Esophagus, diseases of, 440;
foreign bodies in, 443;
four open safety-pins in, 442;
lye strictures of, 441;
radium therapy in cancer of, 444;
radium treatment of carcinoma, 445

Esophagoscopy, and bronchoscopy, 469

Ether, in treatment chronic suppurative otitis media, 270

Ethmoid, conservation of, in surgery, 378

Eustachian injection, in treatment of catarrhal deafness, 216

Evolution, of nasal cavities and sinuses, 362

Eye, treatment of chemical burns of, 83;
and ear, 164;
and ear, relationship between diseases of, 164;
and teeth, 175;
elective localization of bacteria in, from infected teeth, 174;
tuberculosis of, 177

Eyelids, the, 64
edema of, 64
sarcoma of, 69;

Fatalities, further studies of, following operations on nose and throat, 321

Field, of oculist, meets that of practitioner, 26;
of vision, 196

Finsen light baths, in treatment of rhinolaryngological tuberculosis, 457
Fractures, nasal, immediate and late treatment of, 345;
  nasal, treatment of new adjustable splint, 346
Frequency, of sphenoidal sinus operations, 380
Furunculosis, of external auditory canal, 235
Gasserian ganglion, otitis media complicating operations on, 254
Gentian, use of, 259;
  posterior scleral puncture in acute, 140;
  some phases of, 123;
  thesis on etiology of, and a new operation, 132
Glossodynia, control through nasal ganglion, 396
Glaucoma, 122
Goitre, exophthalmic, resulting in blindness from corneal ulcers, 86
Gradenigo, symptom complex, 307
Gullstrand, slit lamp, 102
Halle, operation for ozena, 359
Hay-fever, treatment of, 281;
  airplane tests, of pollen density, in upper air, 388;
  recognition of specific pollens of, 388
Hearing, hard of, problems in relation to the, 211;
  and deafness, 211;
  improvement of, in catarrhal deafness, 238
Hyalitis, of indeterminate etiology, 145
Hydrophthalmus, mechanism of increased tension in, 141
Infections, of middle ear, bacteriologic study of, 248;
  focal, and the tonsil, 408;
  of throat, 337;
  tonsillar, and systemic diseases, 406
Injury, experimental, by sound, 244
Inoculations, experimental, in acute coryza, 334
Instruments, for making and recording hearing tests, 216;
  new, 201
Insulin, treatment, in diabetic lipemia with lipemia retinalis, 99
Ionization, in treatment of purulent otitis media, 261;
  zinc, in treatment chronic middle ear suppuration, 266
Iridectomy, technic of, 135
Iris, the, 87;
  decoloration of, 89
Iritis, etiology of, 87;
  tuberculosis, tuberculin in, 191
Jugular bulb, septic otic thrombosis of, 305
Keratitis, interstitial, bismuth in treatment of, 85
Labyrinth, present position of surgery of, 316
Labyrinthitis, 316, 322
Lacrimal needle, and punctum dilator, 207
Laryngitis, acute catarrhal, 450
Laryngo-fissure, some observations on, 466
Larynx, cancer of, operative treatment of, 463;
  directoscop of Häslinger in diagnosis and surgery of, 468;
  diseases of, 447;
  hemangioma of, 454;
  intrinsic cancer of, notes on fourteen cases of, 462;
  malignant disease of, early treatment of, 461;
  malignant neoplasms of, 465;
  relation of olfactory sense to, 344;

tuberculosis of, 455
Lautenschlager, operation for ozena, 359
Lens, the, 102;
as seen through Gullstrand slit lamp and corneal microscope, 102;
cataractus, removal of, by vacuum method, 108
Lesions, tuberculosis in oral cavity, diagnostic importance of, 392
Lipemia retinals, in lipemia diabetic, effect of insulin in treatment of, 99
Lung, bronchoscope drainage in suppurative diseases of, 475
Mastoid, and sinuses, 276;
acute, its prevention and treatment, 276;
acute, surgical, 281;
bandage, 295;
disease, acute, tenderness in, 290;
disease, study of, by *x*-ray, with operative findings, 277;
disease, with sixth nerve paralysis, 307;
operations, indications for, under local anesthesia, 285;
operations, under local anesthesia, 284;
surgery, two hundred cases of, 292
Mastoiditis, acute, without any aural discharge, 289;
atypical, 286, 288;
without any apparent involvement of middle ear, 287
Medical diagnosis, ophthalmoscope in, 15
Membrana tympani, pathological changes in, 246, 252
Meningitis, acute, 306
Methods, of detecting alleged deafness, 213
Milk, parenteral injections, in ocular therapeutics, 195
Moulds, wax, in relieving symblepharon, 71
Muscles, ocular, 152
Nasal accessory sinuses, 362
cavities and sinuses, evolution of, 362;
fractures, immediate and late treatment of, 354;
ganglion, control of earache through, 238;
obstruction, treatment of, by resection of inferior turbinate, 348;
operations, in bronchial asthma, 391;
polypi, roentgen therapy in treatment of, 354;
septum, abscesses of, 347;
septum, submucous resection of, 351;
sinus, disease, referred pain of, 364
Neoplasms, malignant, of pharynx and larynx, 465
Nerve, optic, 118
Nose and throat, 327;
child's, kept clean by aspiration, 343
Ocular phenomena, produced by intracranial lesions, 121;
muscles, 152;
therapeutics, 182;
tuberculosis, 177
Oculist, field of, meets that of practitioner, 26
Olfactory sense, relation to larynx, 344
Operations, nose and throat, fatalities following, 327
Ophthalmia, Neisserian, autogenous serum treatment of, 182
Ophthalmic column, for oculists, 201
Ophthalmoscope, in general medical diagnosis, 15
Ophthalmology, trend of, 11

Optic nerve, 118;
  involvement, anatomical and x-ray study of optic canal in cases of, 118
Ossification, in chalazion, 73
Otitis, external, its causes and prevention, 237;
  media, 259;
  media, acute, 263;
  media, as a factor in malnutrition in children, 252;
  media, complication, operations on gasserian ganglion, 254;
  media, in infants and children, 252;
  media, suppurative, end results in, 256;
  scarlet fever, 256
Otologic cases of interest to general practitioners, 247
Otology, local anesthesia in, 252
Otorrhea, causes of persistent, after simple mastoid operation, 293
Ozena, 357;
  frequency in different countries, 357;
  surgical treatment of, 358;
  report of Halle and Lautenschlager operations for, 359
Pain, in ear, 240;
  mechanism of, as seen in otological cases, 242;
  referred, in nasal sinus disease, 364
Painful accommodation, control of, 59
Paralysis, sixth nerve, with mastoid disease, 306
Pharyngolaryngitis, acute septic, 439
Pharynx, malignant neoplasm of, 465
Pillars, apparent deformities of, seen after ideal tonsillectomy, 413
Poison, sold by grocers, 328
Poisoning, cocain, death from, 328
Pressure, negative, in treatment of diseases of nose and accessory sinuses, 377
Problems, in relation to the hard-of-hearing, 211;
  some of more recent, in rhinology, 356
Pulmonary abscess, etiology of, 412
Punctum dilator, and lacrimal needle, 207
Radium, in treatment of malignant tumors, nose and throat, 331
Refraction, 48;
  and accommodation, 48
Retina, the, 96
Retinitis proliferans, etiology of, 96;
  lipemia, effect of insulin treatment on, 99
Rheumatism, acute, results of tonsillectomy on, 426
Rhinology, some recent problems of, 356
Roentgen ray, study of 50 post-tonsillectomy tuberculosis cases, 405
Roentgen therapy, in treatment nasal and throat polypi, 354;
  deep, and radium therapy in carcinoma of the tonsil, 415;
  in chronic tonsillitis and pharyngitis, 420
Sarcoma, of eyelids, 64
Scleral puncture, in acute glaucoma, 140
Separator, anterior mucous membrane, modification of, 348
Serum, autogenous, in treatment Neisserian ophthalmia, 182;
  antidiphtheritic, in ocular infection, 185
Sinus, nasal, referred pain in, 364;
  disease, treatment of, in infants and children, 373;

- maxillary, conservative treatment of, 375
- Sinuses, 276;
  - intracranial, phlebothrombosis of, 300
- Sinusitis, accessory, sources of diagnostic error, 366;
  - in children, 371;
  - in infancy and childhood, 371
- Squint, concomitant, surgical treatment of, 152
- Stenosis, post-diphtheritic laryngeal, 447
- Strabisinus, muscle "folder" for, 203
- Studies, of fatalities following nose and throat operations, 327
- Study, of acute infections of throat, 337
- Submucous resection of nasal septum in children, 351
- Suction, in treatment of septic ears, 260
- Suppuration, chronic, treatment of middle ear, by ionization of zinc, 266;
  - acute, of middle ear, indications of surgical intervention in, 282
- Surgery, mastoid, two hundred cases of, 292
- Symblepharon, relieved by wax moulds and skin grafts, 71
- Syphilis, late congenital, deafness in, 224
- Technic, of iridectomy, 135
- Teeth, and the eye, 174
- Tenderness, in acute mastoid disease, 290
- Tests, of hearing, instruments for making and recording of, 216;
  - fundamental, 216;
  - methods and interpretation of functional, 216
- Thoracopuncture, intercostal, 477
- Thrombosis, lateral sinus, etiology and diagnosis of, 297;
  - of cavernous sinus, 305;
  - septic, diagnosis and treatment, 302;
  - septic otitic, of cranial blood sinuses, of jugular bulb, 305
- Tinnitus aurium, 245;
  - associated with abnormalities of blood pressure, 244
- Tongue, cancer of, 392
- Tonsil, the, 398;
  - and focal infection, 408;
  - bacteriology of extirpated, 404;
  - direct blood stream infection through, 402;
  - indictment of, 410;
  - new technic for removal of, 416;
  - study of crypt content of, in man, pig, and cow, 399;
  - tuberculosis of, 405
- Tonsillectomy, effect on general health of twelve hundred children, 427;
  - further use of tissue juices in, 418;
  - indications and contra-indications of, 410;
  - reaction of peritonsillar tissues to, 412;
  - results of, on acute rheumatism in children, 426
- Tonsillitis, acute, prophylactic vaccination against, 414;
  - chronic, and pharyngitis, indications for roentgen therapy in, 420
- Trachoma, 73
- Treatment, bismuth, in interstitial keratitis, 85;
  - conservative, in maxillary sinus disease, 375;
  - early, importance of, in chronic nasal catarrh, 340;

ether, in chronic suppurative otitis media, 270;
of acute mastoiditis, 276;
of asthma, hay-fever, 381;
of chemical burns of eye, 83;
of nasal obstruction, by submucous resection of inferior turbinate, 348;
of para-nasal sinus disease in infants and children, 373;
of purulent otitis media by ionization, 261, 266;
radium, of tumors of nose and throat, 331;
routine of, in acute otorrhea, 258;
surgical, of deafness, 234
Trend, of American ophthalmology, 11
Tuberculin, in tuberculosis iritis, 191
Tuberculosis, of larynx, chaulmoogra oil in treatment of, 456;
rhino-laryngological, treatment of, by Finsen light baths, 457
Ulcer, corneal, in exophthalmic goitre, 86
Ultraviolet irradiation, influence on calcium content of blood serum, 384
Vaccination, prophylactic, against acute tonsillitis, 414
Vaccine, barrage doses of, in treatment Neisserian ophthalmia, 182
Vernal, conjunctivitis, 77
Vertigo, and the otologist, 318;
and its significance in general medicine, 321
Vision, field of, 196
Vitamine, diet, as factors in otolaryngological conditions, 356
Vitreous, the, 145
X-ray, examination of nasal sinuses by four projections, 378;
in study of mastoid disease, 277, 278;
in treatment of deafness, 228;
study of optic canal in optic nerve involvement, 118;
treatment of chronically infected tonsils and adenoids, 422

AUTHORS' INDEX

Abraham, J. H., 259
Adkins, G. E., 237
Alden, A. M., 313, 328
Alexander, A., 357
Alvis, B. Y., 26
Appleton, J. L., Jr., 392

Baldenweek, M. L., 330
Barenberg, L. H., 430
Beatty, H. G., 450
Bedell, A. J., 102
Berkley, H. K., 473
Bloomberg, M. W., 430
Bloomfield, A. L., 414
Boot, G. W., 284
Briggs, H. H., 455
Bronfin, I. D., 456
Brown, E. V. L., 87
Butler, T. H., 48
Byrd, H., 63

Calkins, J. W., 204
Carmody, T. E., 445
Carter, W. W., 347

Chamberlin, W. R., 307
Charlton, C. C., 300
Clapp, C. A., 142
Clerf, S. H., 238
Coakley, C. D., 369
Coates, G. M., 295
Cohen, L., 345
Cordes, F. C., 73
Cords, R., 89
Cowen, S. B., 281
Crampton, G. S., 201
Crowe, S. J., 402, 405

Dabney, S. G., 439
Davis, D. J., 400
Davis, W. B., 371
Dean, L. W., 373
De Schweinitz, G. E., 305
Dietrich, H., 473
Diggle, F. H., 466
Dowell, G. S., 408
Drury, D. W., 222
Duke, W. W., 381

Emmerson, F. P., 226, 293
Ersner, M. S., 278, 288

Felty, A. R., 414
Fernando, 115
Fetterolf, G., 412
Fisher, T. A., 64, 69
Foster, J. H., 447
Fouts, J. D., 375
Fox, H., 412
Fox, M. C., 266
Franklin, W. S., 73
Fraser, J. S., 305, 462
Fraser, G. S., 380

Galbraith, E. G., 270
Gallison, J. G., 272
Gamble, W. E., 178
Gardner, M., 101
Gettinger, G. H., 410
Gibb, J. A., 364
Gilhespy, F. B., 256
Glassburg, J. A., 358
Goldstein, M. A., 218
Green, J., 62
Greene, J. B., 419
Grier, G. W., 415
Groves, R. L., 334
Guisez, J., 444
Guthrie, J. K., 340

Haden, R. L., 175
Hayes, H., 252
Hempstead, B. E., 287
Hilgartner, H. L., 81
Hill, F. T., 247
Hillis, A. E., 182
Hinton, J. W., 86
Hollender, A. R., 384
Hubert, L., 342
Hughes, T. E., 288
Hunt, G. H., 426
Hurst, V. R., 83
Hutton, J. H., 429
Hyslop, G. H., 161

Ingham, S. D., 199
Irons, E. E., 87
Israel, Z., 468
Ivig, R. H., 392

Jackson, C., 329, 442, 475, 477
Jackson, E., 15
Jervey, J. W., 131
Jordan, E. O., 333

Kahn, M. H., 391
Kaiser, A. D., 427
Kearney, J. A., 24
Keidel, A., 224
Keiper, G. F., 257
Kemp, J. E., 224
Kelly, I. D., Jr., 435
Kerrison, P. D., 231, 234, 282
Key, B. W., 186
King, C. R., 289
King, E., 306
Kleefield, G., 85

Larkin, B. J., 97
Levy, L., 318
Lewy, A., 397
Lewis, T. O., 461
Lillie, W. I., 122
Lobell, A., 352
Loeb, H. W., 327
Long, F. L., 386
Love, J. M., 371
Lyons, H. R., 254
Lyster, T. C., 198

Mace, L. S., 192
Makenty, J. T., 463
Mann, J., 36

Markel, C., 456
Milligan, W., 316
Mitchie, H. C., 216
Mithoeffer, W., 359
Moore, T. W., 195
Morgan, T. R., 245
Motogoro, K., 245
Myerson, M. C., 472
MacCready, P. B., 405
McCarthy, M. C., 292
McGinnis, E., 378
McKinney, R., 441
McKinzie, D., 316
McLallen, J. I., 262
McMannus, T. U., 256
McReynolds, J. O., 11

Nakamura, T., 404
Newhart, H., 211
Newmann, H., 252
Norton, J. F., 333
Novak, F. J., Jr., 384

O'Brien, J. J., 147
Odeneal, T. H., 252
O'Malley, J. T., 362
Osman, A. A., 426
Otrich, G. C., 377

Parker, F. C., 110
Parker, W. R., 71
Patton, W. T., 222
Pearson, W. W., 469
Penticost, R. S., 321
Peters, 152
Pfahler, G. E., 277
Phillips, W. C., 302
Pomeranz, M. M., 365
Posey, W. C., 77
Pratt, F. J., 413

Ranson, J. R., 331
Reese, R. G., 135
Renaud, M., 306
Reye, 437
Richardson, J. J., 228
Robertson, R. C., 334
Ross, E. L., 398
Rowland, D. W., 343
Rowe, A. H., 100
Roy, D., 165

Salinger, S., 346
Sargnon, 465
Scheppergrell, W., 388
Shambaugh, G. E., 356
Shekter, A. J., 348
Shuster, B. H., 295
Sluder, G., 62, 396
Smiley, D. F., 338
Smith, E. T., 140
Smith, S. M., 297, 309
Sonnenschein, R., 213, 216
Soto, E. F., 410
Spilberg, W., 348
Stanton, C. C., 235
Steffanson, O. M., 416
Stout, P. S., 285
Strandberg, P., 457
Strobie, W., 226
Stuart, Low W., 260
Stuckey, J. A., 356
Sulzman, T. M., 240
Sweet, C. D., 252
Swett, W. E., 32

Taylor, C. B., 276
Taylor, J., 117
Tenner, A. S., 207
Tesar, W., 443
Townsend, J. F., 80
Truesdale, P. E., 392

Ubaldo, 115
Ullman, E. V., 344

Valentine, E., 248
Vinson, P. P., 440

Ware, J. G., 354
Warwick, H. L., 261
Waters, C. A., 422
Watkins, E. D., 216
Watson-Williams, S., 322
Wharry, H. M., 244
White, D. W., 73
White, F. W., 351
White, P. C., 73
White, L. E., 119
Wilder, W. H., 122
Winslow, P. V., 238
Wishart, D. E., 430
Witherbee, W. D., 420
Wolfe, O., 258

Yearsley, M., 290